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MOTORSHIP

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Devoted to Commercial and Naval Motor Vessels

Vol. 2 DECEMBER, 1917 No. 12

SEATTLE NEW YORK

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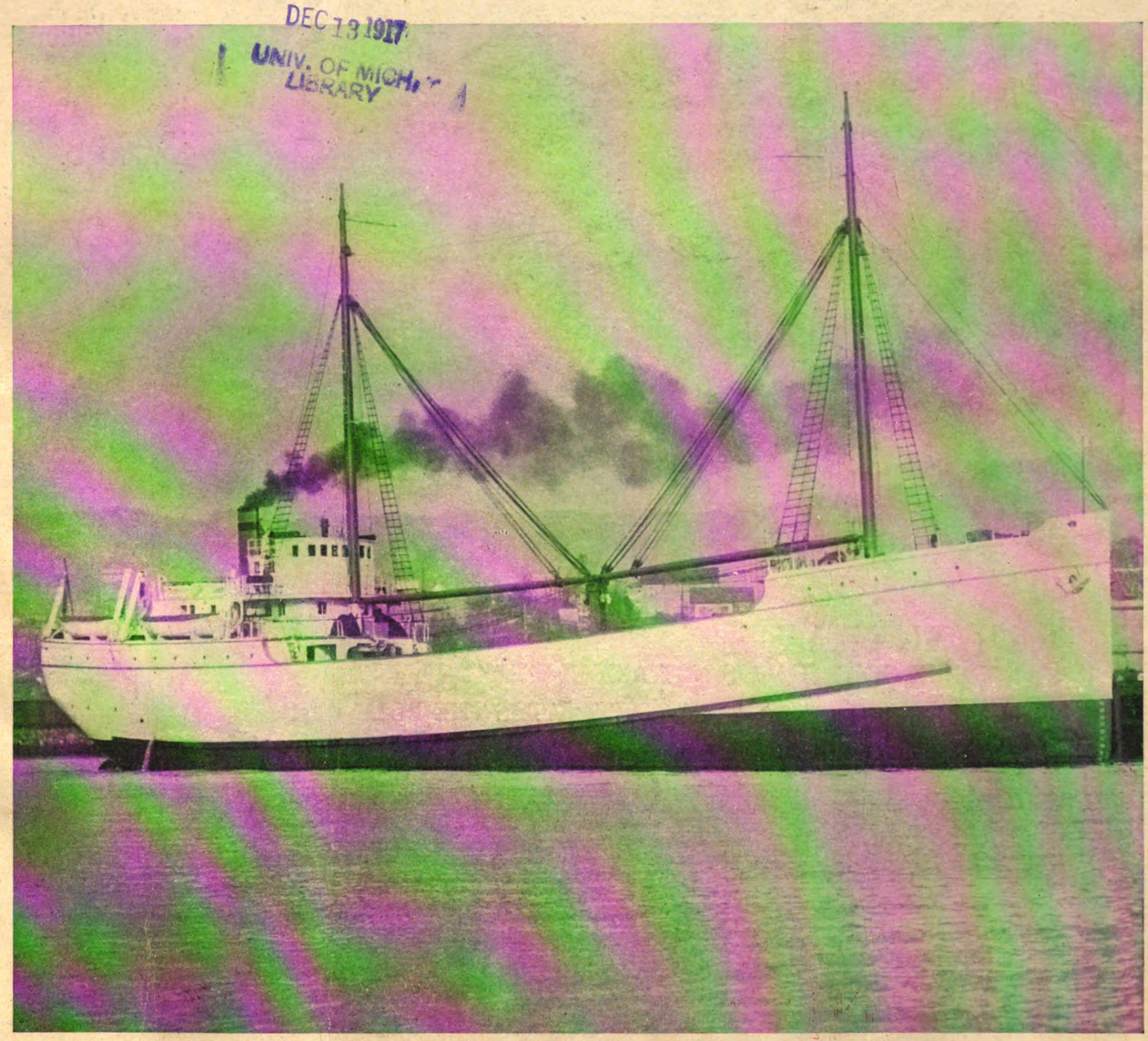

AMERICAN MOTORSHIP "OREGON"

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Vol. 2 SEATTLE, U. S. A., DECEMBER, 1917 No. 12

The American Motorship "Oregon"

THE motorship "Oregon," which has just been placed in commission, is exceptional in the fact that entire reliance is placed upon oil engines for both the propelling and auxiliary power. It is customary to have at least a donkey boiler to fall back upon in vessels of this type. In the "Oregon" no steam is used whatever, not even for heating the vessel's living quarters. Electricity generated by oil engines is used for all heating, cooking, and for operating the vessel's winches, windlass and steering, which means that at no time will she have a fire on board, even in the ship's range.

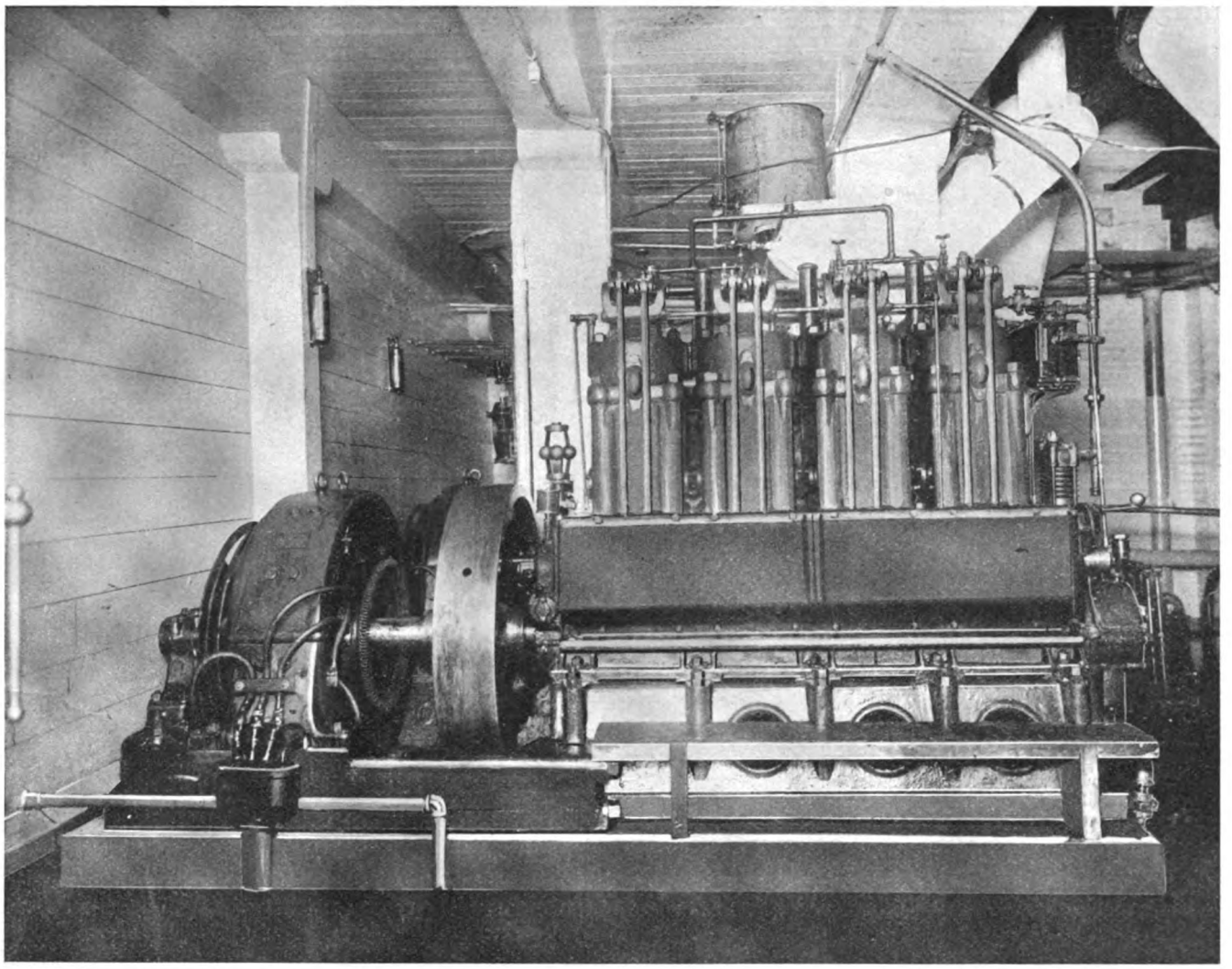
The "Oregon" was completed and launched from the yards of Alaska Pacific Navigation Company, Seattle, in February but due to the non-delivery of her main engines she has been held up since that time. She was built to the designs of R. M. Semmes, vice-president of the company, and a very good idea of her appearance can be obtained from the cover of this issue of Motorship. Her arrangements will also be noted from the accompanying photographs. She is 234 feet long, 42 feet beam and 23 feet moulded depth. She is designed for freight and passenger service, and will be used for general coasting service augmenting the fleet of the company.

The vessel is propelled by two 4-cylinder, two-cycle, Southwark-Harris Diesel-type engines of 650 i. h. p. each. These are of the vertical step piston type supported by solid back column construction. The dimensions of the cylinders are 14'x21'—they are designed to develop 400 b. h. p. at 200 r. p. m. A three stage air-compressor is driven off the forward end of each main engine, these are high and low stage and they charge the cold storage bottles with air at a pressure of 900 lbs. per sq. in. for fuel injection purposes. On the outer casing of the low stage compressor are carried the various pressure gauges, in a convenient place for the engineer; also here is the single control wheel, by means of which the engine is started, stopped and reversed. On the front of the cylinders is the cam-shaft, off which the fuel valves are actuated. This shaft is operated by means of spur-gearing and includes vertical shaft off the forward crank-shaft. The Southwark-Harris of this size differs somewhat from the smaller sizes having the automatic valve for admitting the scavenging-air from the step-piston chamber into the manifold that feeds the working cylinder replaced with a mechanical rotary valve, and the design of the lower part of the step-piston has been altered to enable it to be used as a guide for the cross-head, as it has been found by the majority of Diesel engineers to make all larger engines on the cross-head principle, especially marine models.

There are a number of excellent features in the Southwark-Harris engine; among these may be mentioned the neat reversing mechanism, the presence of one opening in the cylinder-head—that for the fuel-injection valve—which enables a simple design of cylinder head to be adopted, general accessibility, the fuel-pump governing device, and the excellent balance obtained with the firing, particularly with this size engine. Being of the two-cycle type there are six impulses per minute.

Another feature is that the lower or step-pistons, are used as pneumatic engines when maneuvering, and their large areas permit the use of fairly low-pressure air, meaning small air-reservoirs in a vessel. In shop starts this engine started on about 95 lbs. pressure, but in practice about 200 lbs. are used. Low pressure air is used for starting and reversing.

The cylinders are mounted on a cast-iron frame, which is supported front and back by steel columns direct to the bed-plate, the studs that hold the cylinders passing down into the columns. By unscrewing the nuts the columns on the starboard side can be removed, allowing the crank-shaft to be removed sideways without disturbing the other



ONE OF THE 40 H. P. BURNOIL ENGINES ABOARD THE "OREGON," DRIVING A 25 K. W. GENERAL ELECTRIC MOTOR WHICH GENERATES THE ELECTRICITY FOR THE DECK MACHINERY AND AUXILIARY HEAT AND LIGHT.

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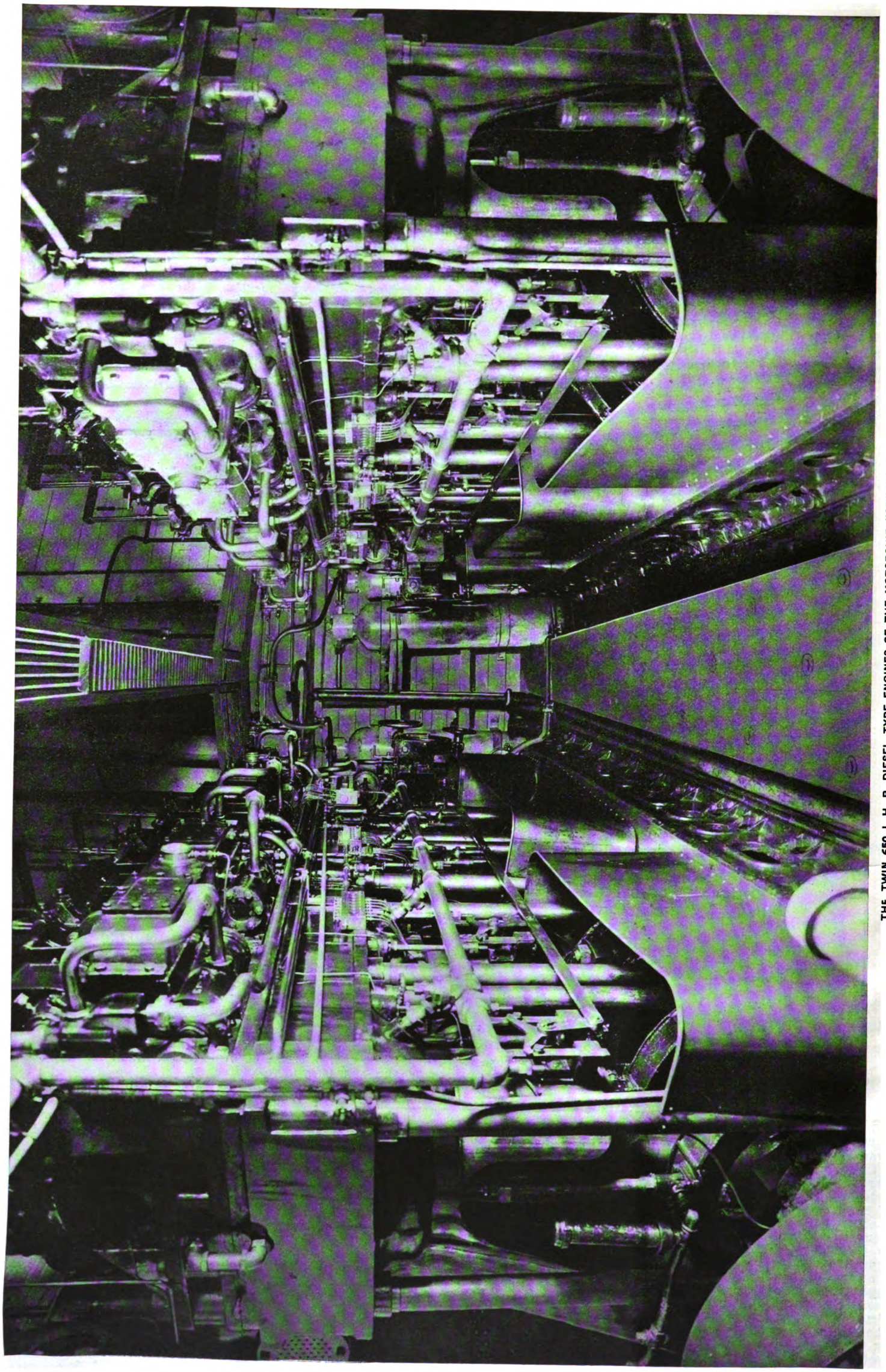

THE TWIN 650 I. H. P. DIESEL TYPE ENGINES OF THE MOTORSHIP "OREGON"

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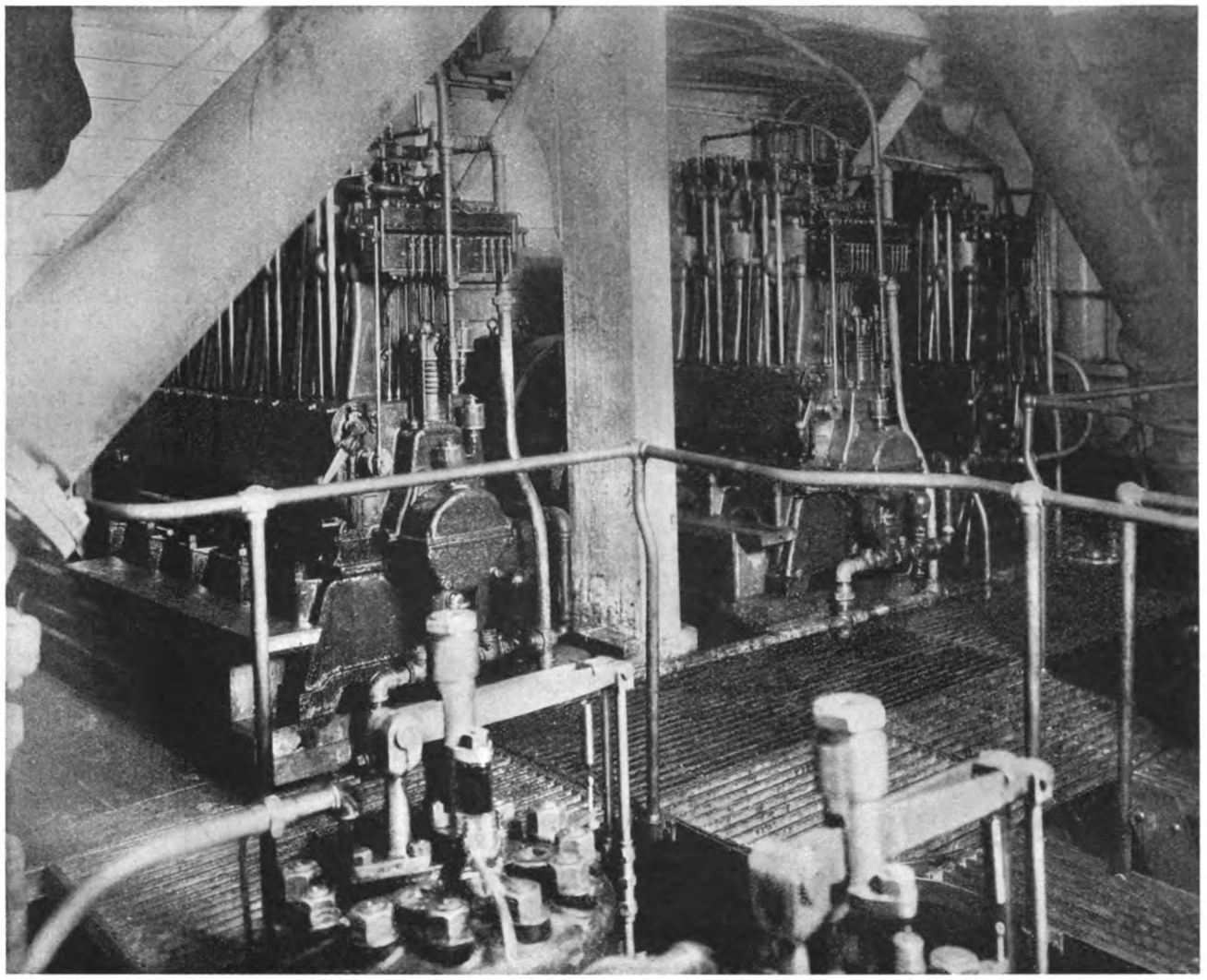
parts of the engine. Any bearings can be removed and replaced without taking out the crank-shaft. The main bearings are carried right between each set of steel columns, allowing the latter to absorb much of the tension strains given by the pistons. The crank-pit is covered by two detachable steel doors on the front, the cast-iron bearings on the back acting as effective splash-guards.

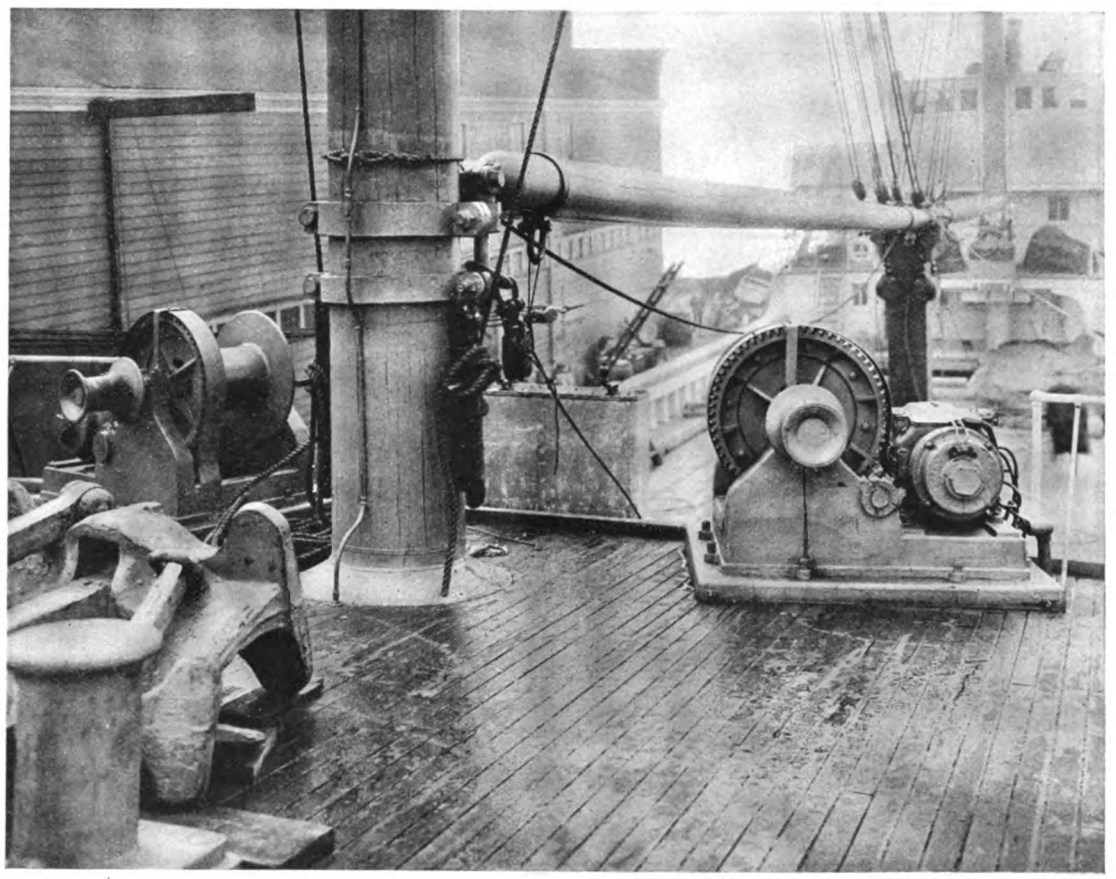
The lubricating oil is fed from force feed Richardson Phenix lubricators to the main working parts and what oil collects in the base is pumped back to the oil (Richardson Phenix) filters and through gravity feeds to the main bearings, and in this way is used over again. The auxiliary fire pumps are the two-stage type and with the auxiliary air-compressor are driven by a 15 h. p. Fairbanks-Morse motor, which also drives the high pressure fire and bilge pumps and is so piped to the main engines as to feed the circulating water to either or both main engines in case of an emergency. It is also piped to supply the auxiliary engines with circulating water in case of emergency. The sanitary and fresh water pumps are of the centrifugal type and are connected to a 5 h. p. motor. The air storage bottles—15 in number, 8 high and 7 low pressure—are all subject to a 5,000-lb. test. The installations of all main and auxiliary engines as well as other equipment was carried out by E. L. Lowe, marine engineer, for the Pacific Machine Shop and Manufacturing company who received the installation contract from the Standard Gas Engine Co.



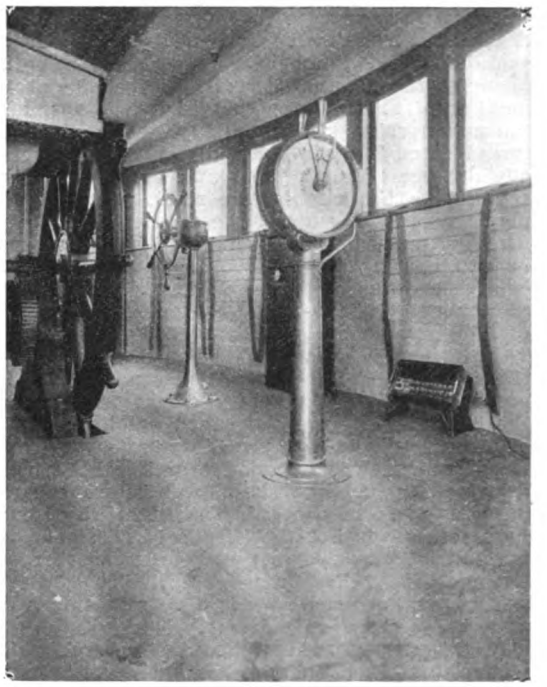
THE THREE BURNOIL AUXILIARIES, 40, 40 AND 10 H. P.

Electricity plays an important part in the fitting-out of the "Oregon;" the cargo hoists, anchor windlass, steering gear, heating and lighting systems are all electrical. The power for driving the deck and anchor machinery, steering gear, etc., is generated by three General Electric motors of 25, 25 and 7½ k. w., driven by two four-cylinder, four-cycle type 40 h. p., and one single-cylinder 10 h. p. four-cycle Burnoil engines. The larger two of these are used for the deck machinery and for auxiliary heating and lighting, and the smaller for the main lighting. These engines were supplied by the Burnoil Engine Company of South Bend, Indiana.

The principle upon which this engine works was first produced in Holland by the Brons Motor Works of Appingedamm, and afterwards also by the Deutz Company of Cologne, Germany. The Burnoil Company have the sole American rights to manufacture under this patent. In moderate powers and on light residual oils and on kerosene this type of engine has proven itself very successful and economical. Many have been installed aboard the large European motorships. This engine is also built in England by J. Samuel White & Co., Ltd., of Cowes, Isle of Wight, the famous torpedo boat destroyer builders who have had very fine results from it. The Burnoil engine is of the four-cycle type, and as with the Diesel cycle, heat for combustion is supplied by compressing atmospheric air to about 450 lbs. to the square inch; but the method of introducing the oil fuel into this heated air is quite different and it is claimed that just as much, if not more, heat units are obtained from the fuel by the method adopted. Fixed in the cylinder head and partly protruding inside the combustion chamber is a small cup or container and the oil fuel is fed into this cup by gravity by way of a needle valve and



ELECTRIC CARGO HOISTS OF THE "OREGON," CONTROLLER AFT AND FOREMOST



PILOT HOUSE OF "OREGON," SHOWING SMALL HAND WHEEL FOR ELECTRIC CONTROL OF HELM AND ALSO ONE OF THE ELECTRIC HEATERS

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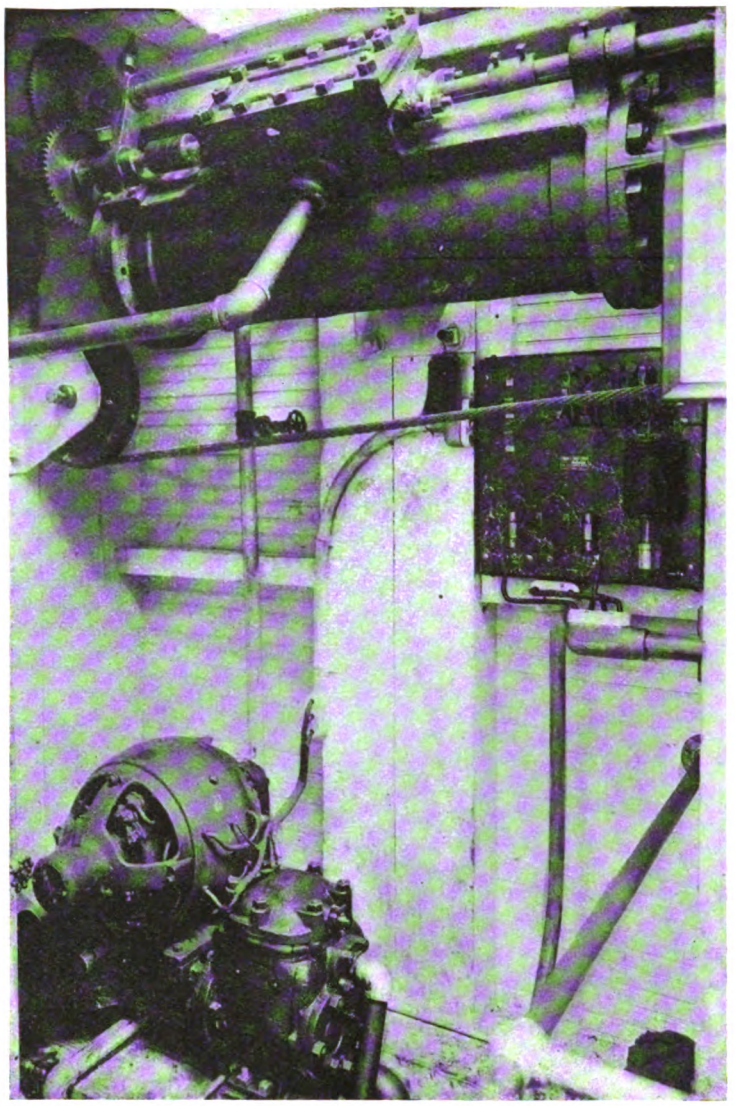


ELECTRIC STEERING GEAR OF "OREGON"

the fuel valve, these valves being open on the suction stroke, the needle valve regulating the quantity of oil. In the walls of the cup are a number of small holes, and toward the end of the compression stroke the highly heated air is forced through these holes, also the walls of the cup are heated, with the result that part of the fuel inside the cup is vaporized. Just as the piston reaches the top of the stroke the temperature becomes sufficiently high to ignite the vapor formed, causing a miniature explosion within the cup. The force of this explosion is greater than the cylinder compression, consequently the still fuel oil remaining is sprayed through the holes into the cylinder where the main combustion takes place and the piston is driven down on its power stroke. On the next up-stroke of the piston the burned gases are scavenged out through the exhaust valve, and on the following down-stroke clean atmospheric air is drawn in, the suction drawing the fuel into the cup as before and the previous cycle of operations is repeated. Hence no electrical or hot-bulb device is necessary for ignition. We are showing photographs of these engines aboard the "Oregon."

The steering machinery is a very ingenious device, being electrically driven.

It has an automatic follow up control which means that when the wheel is put over a certain number of degrees the rudder follows up the wheel to that degree and then stops automatically. Oil is used for fluid so as to prevent freezing. This is kept at a pressure of 125 lbs. Oil under pressure is drawn from a pressure tank and discharged from the cylinder into a sump tank. (The pressure tank is half full of oil and half full of compressed air, which acts as an elastic medium, preventing the pressure from dropping sharply when the cylinder is working). An electrically driven pump draws the oil from the sump tank to the pressure tank. The pump is controlled by a pneumatic switch. When the pressure drops 5 lbs. in the pressure tank this switch cuts in and starts the motor and the pump continues to run until the pressure is at 125 lbs. and then it automatically stops.

The steering gear is controlled by a small brass steering column located in the pilot house which has a tell-tale dial. This is connected by shafting and gears to the valve of the cylinder which is located in the engine room trunk. The valve control is provided with positive stops to prevent over running in either direction. The Pacific Machine Shop and Manufacturing Co., are building these gears for various sized vessels along with all types of steam, electric, hydraulic and hand gears.

A feature not found on similar ships is the electric heating as supplied to each stateroom and cabin, to the saloon and crew's quarters. In each of these compartments is an electric heater supplied by the American Electrical Heater Company of Detroit.

These give ample heat and are especially adaptable for ships of this type.

The deck machinery is of the type supplied by the Pacific Machine Shop and Manufacturing Company of Seattle, Wash., to a great number of auxiliary powered ships on the Pacific Coast. It has been found to be of great efficiency and is destined to be standard equipment aboard vessels of these types. The Washington Iron Works of Seattle supplied the electric anchor windlass which we illustrate.

A few particulars of the "Oregon" follow:

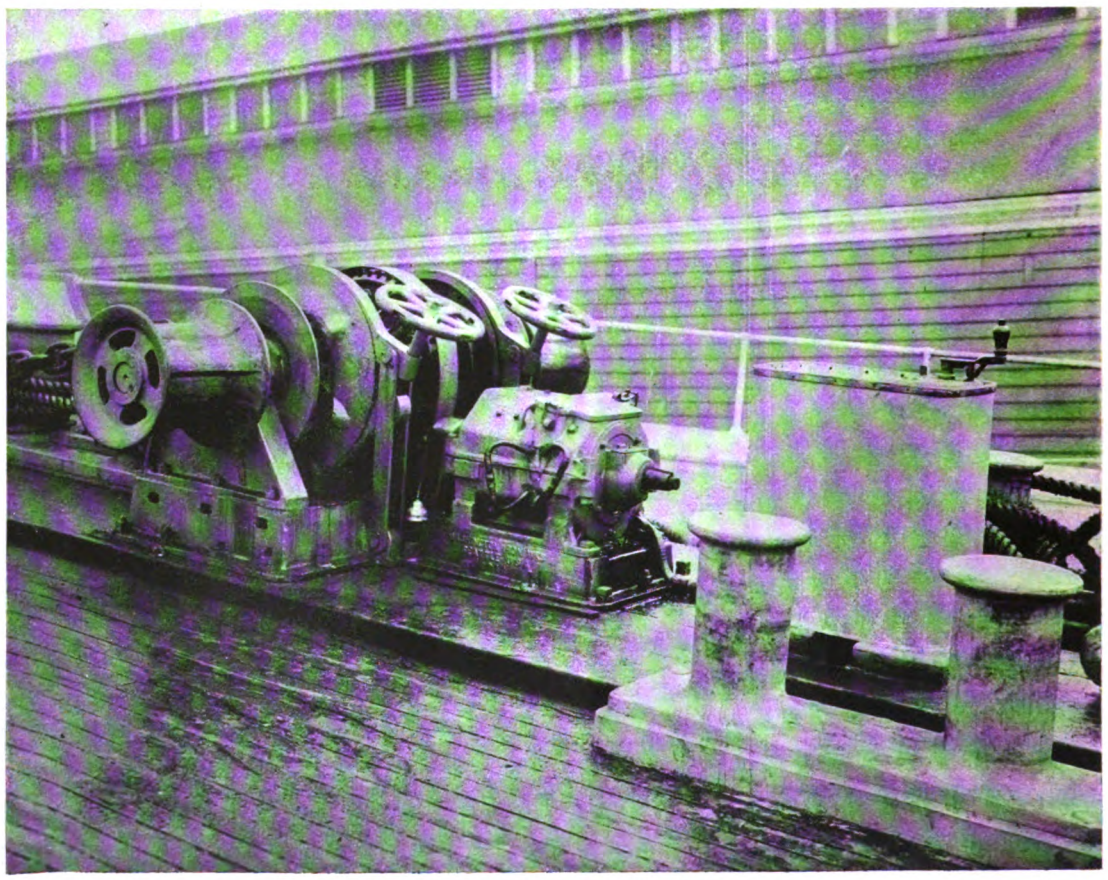
Owners and operators—The Alaska Pacific Navigation Company, Seattle, Wash.
Builders of hull—The Alaska Pacific Construction Company, Seattle, Wash.
Builders of Diesel engines—Lyons Atlas Company, Indianapolis, Ind.
Hull completed—February, 1917.
Engine installation completed—November 7, 1917.
Gross tonnage—1630 tons.
Net tonnage—1280 tons.
Dead weight capacity—3200 tons.
Cargo capacity—2500 tons.
Fuel carried—700 bbls.
Water carried—12000 gals.
Length of ship over all—235 feet.
Length of ship, B. P.—218 feet.
Breadth—42 feet.
Moulded depth—23 feet.
Draught loaded, aft—21 feet.
Engines—Twin 5-cylinder, 14 in.x21 in., two-cycle, Diesel type, Southwark-Harris.
Fuel consumption at 11 knots—17 bbls. per engine for 24 hours.
Indicated horse power—650 per engine.
Brake horse power—400 per engine.
R. P. M.—200.
Starting-air pressure—200-300 lbs.
Engine room crew—7 men.

The "Oregon" is loading with a cargo of coal for San Francisco but the plans for the further use of the vessel have not been definitely laid to date.

SULZER LICENSEES.

Among the marine Diesel engine constructional licensees of Sulzer Freres of Switzerland, may be mentioned the following well-known companies:

Busch-Sulzer Co., of St. Louis, Mo., U. S. A.; Chantiers et Ateliers de La Loire, Loire, France; Forges et Ateliers de La Mediterranée, La Seyne, France; Ansaldo & Co., Genoa, Italy.



ELECTRIC ANCHOR WINDLASS OF THE "OREGON"

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Prospects of the Marine Oil-Engine Industry in America

The Importance of Prompt Government Action

JUST at the present time the marine oil-engine industry of the United States is in a most flourishing condition, and most of the builders are busier than they ever have been in their history, despite their being forced to charge abnormal prices, because of the high cost of materials and labor. Yet, the immediate future of those domestic manufacturers engaged in constructing motors of 200 b. h. p. and upwards is in the balance, and the suspense of some definite action on the part of the U. S. Shipping Board Emergency-Fleet-Corporation hangs like the proverbial sword of Damocles over their heads.

The powers-that-be at Washington have filled up the more important shipyards and engine-works with enough steamships and steam machinery to keep them busy for several years to come, all the orders for motorships and oil-engines now under construction having been contracted for by shipowners before the authorities took over control of all ships built and building of 2,500 tons and over.

So far, the Emergency Fleet Corporation has not placed a single order for a marine oil-engine or for a motorship, and the controlling officials will only allow contracts for motorships to be accepted by shipyards from domestic shipowners and from foreign shipowners under stringent conditions, are being told to the effect that such ships can only be built provided it is satisfactorily demonstrated that the materials and labor used will not detract from rapid construction of the steamers now building, and that when the motorships are built they will be subject to possible seizure by the Emergency Fleet Corporation. Doubtless, the latter means that the ships will be seized if of suitable size and if successful results are shown on trials. It is a vague permission!

A few foreigners still seem willing to place orders under those conditions and we must bear in mind that foreigners have been responsible for the placing of orders for about 35% of the motorships built or building in this country during the last two years. Most domestic shipowners for the time being are sitting on the fence awaiting a substantial definition of their status from Washington, meanwhile are placing practically no further orders for large motorships or for high-powered marine oil-engines. In addition to the indefinite attitude of Washington, shipowners have before them the Government-fixed lower freight rates offered against the present abnormally high constructional operation and insurance charges, which already has been felt by several motorship owners as well as by steamship lines. Also, the Government has stopped the operation of motor-driven auxiliary sailing-ships in the war zone with which route many shipowners' sole businesses now are centered.

The authorities at Washington now have had ample time to properly review the entire motorship situation, and some definite action is urgently needed. There should be no further delay otherwise the consequences will be most serious for America's marine oil-engine industry. Either, they should quickly place orders for at least a hundred large oil-engines for installation in ships now on order; or specially lay down a small fleet of big steel and wooden motorships, or else give domestic, and even foreign, shipowners and shipbuilders a free hand to place and accept such orders, and give reasonable assurances that such vessels may be operated by the shipowners themselves under the jurisdiction of the board.

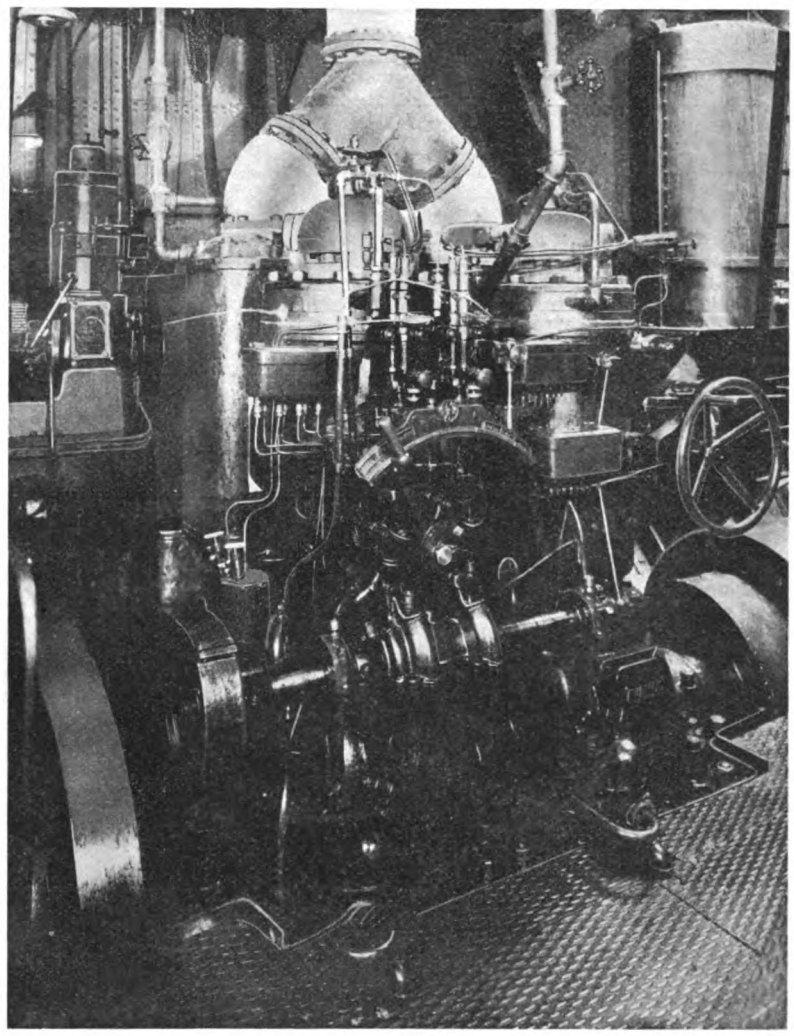
Unless one of these things is done a new American industry is very likely to be nipped-in-the-bud. Any shipowner can see that a rapid development of the marine-oil-engine industry is of the utmost importance to the future of the merchant marine of the United States, and it should receive every encouragement and assistance from those in control of our shipping and shipbuilding. Already we unfortunately are many years behind Europe in this respect, and our Government must take steps to assure that we do not further lag behind, but make up for lost time at this present splendid opportunity.

A few years ago engineers and shipowners of this country did not appreciate the vast extent of business that the marine oil-engine and motorship fields offered them. Consequently enterprising foreign engine-builders stepped into the open breach and secured an enormous number of orders. Competition from domestic concerns was so slight that the 20% customs import-duty had no terrors for these foreign engine-builders.

For instance, one Swedish oil-engine builder during the last 2½ years has engined no fewer than sixty-one American-built steel and wooden motorships of 100 b. h. p. aggregating 24,540 brake-horse-power, and totalling 175,000 tons d. w. c. Together with the engine-room auxiliaries, fittings, spare parts, and smaller motors, this represents nearly five million dollars of good American money that went to Sweden for machinery, and which instead might have been retained in this country.

The doings of these Swedish builders awoke American engineers to the real situation, and many firms recently have entered the marine oil-engine business in an enthusiastic manner. Now, they have got a good start much of their efforts will be in vain unless they receive proper and deserved co-operation from the United States Shipping Board Emergency Fleet Corporation, which we hope soon will be forthcoming, otherwise we shall be worse off than we were before. Motorship has taken the matter up direct with the shipping authorities at Washington so future prospects should very shortly materially improve. The success of America's shipping rests with her wonderful natural oil-supply and the oil-engine is the most logical power for its utilization.

Four Auxiliary Steel Avance-Powered Schooners



ONE OF THE TWIN 120 H. P. AVANCE OIL ENGINES ABOARD THE "PUSEY JONES I"

FOUR steel auxiliary schooners have recently been launched from the shipyards of the Pusey & Jones Co., at Wilmington, Delaware, for Christoffer Hannevig, Inc., New York. They are named "Pusey Jones 1," "Pusey Jones 2," "Pusey Jones 3," and Pusey Jones 4." All of these vessels are of the same size, being 125 feet between perpendiculars, and having a length over all of 147 ft. 6 in. They have a moulded depth of 15 feet and a breadth of 28 feet with a mean draft of 12 ft. 6 in.

The engines are of the crude oil Avance type which develop 120 b. h. p. apiece and are directly connected to the propeller shaft. The propeller blades are cast iron and are three bladed, 65 inches in diameter. With this equipment these vessels are enabled to make 7½ knots per hour.

The first of these ships "Pusey Jones 1" is now on a voyage from Baltimore to Lisbon. No. 2 made the run to France in 27 days. No. 3 completed a trip to Portugal in 25 days. No. 4 is nearing the end of a trip to Lisbon from New York. No trouble has been encountered to date with any of these vessels, and the owners are entirely satisfied.

They will form the nucleus of a permanent line from America to Portugal.

CHIEF ENGINEER COLE.

We have received an interesting letter from Chief-Engineer James E. Cole, late of the motorships "Sebastian," "Abelia," etc., but now with the British Admiralty. He states that he does not care about going to sea with steam-propelled ships any more, as he has lost all interest in them.

STANDARD OIL BUYS ANOTHER MOTORSHIP

Another addition to its growing motor-auxiliary fleet has been made by the Standard Oil Co., they recently having purchased the motor-schooner "Oronite," now building at Benicia, Cal. Her machinery will be installed at Oakland, Cal. It is reported that the purchase price was $275,000.

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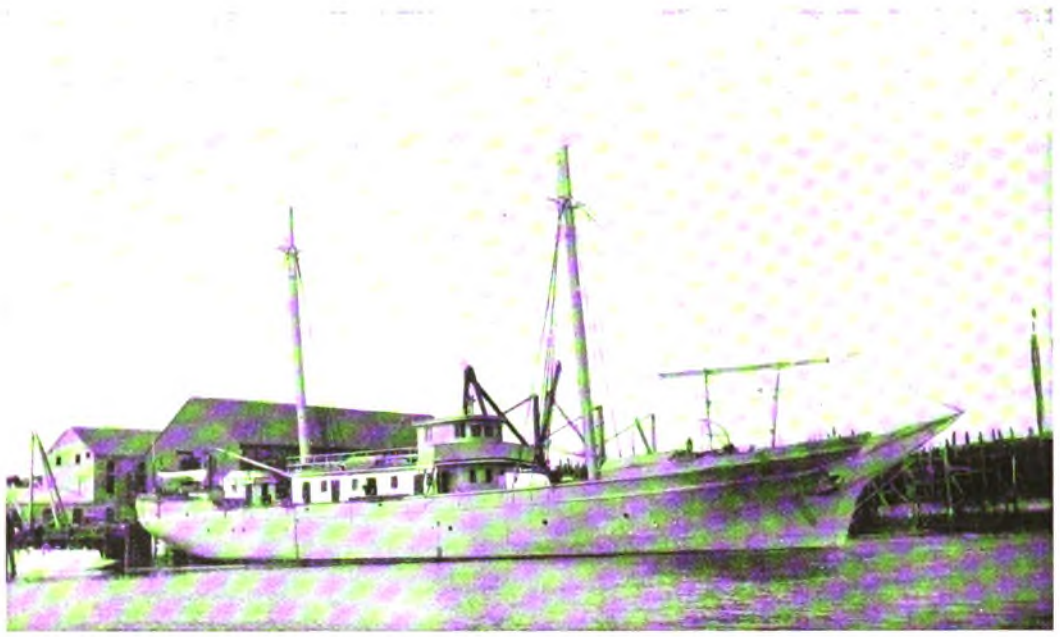

"LAKSCO"—THE LAKE TORPEDO BOAT COMPANY'S SUBMARINE TENDER

Length 165 ft., Draught 8 ft.; Fitted with 200 h. p. Wolverine Kerosene Engine; Built by the Wolverine Motor Works, Bridgeport, Conn.

The Importance of the Diesel Engine in the War

THERE are a considerable number of people in the shipping and shipbuilding businesses who honestly believe that the marine oil-engine has not yet reached the stage of assured reliability, which makes those who know otherwise wonder if these men have appreciated the full extent of the importance that the Diesel engine has in this war. Germany is using (or rather abusing) the Diesel-engine in such a manner whereby the purpose for which she utilizes it positively forms the most serious problem that the Allies have to contend with.

For, without the Diesel-engine Germany's present terrible and unscrupulous submarine-warfare would not be possible, owing to the cruising radius of the U-boats otherwise being too restricted.

Because of its high speed the type of oil-engine used in the submarine represents the Diesel engine in its worst form, because of the much higher mean-temperature to which its cylinder walls, cylinder heads, and pistons are subjected, and it is the unequal temperatures—not air pressures—that produce the strains and stresses which result in cracks. Yet the Diesel engines of the German submarines have shown sufficient reliability to make the craft which they propel a menace and terror to merchant shipping of the world. What better proof does a shipbuilder or shipowner need than this state of affairs? Naturally, a heavy, slow-speed ship's Diesel engine with its low mean temperatures, even is more reliable than the motor of the submarine and needs less skilled men to operate it.

Contrary to the general opinion, Germany as a whole does not build the best examples of Diesel engines, and, if we except perhaps the engine built at Augsburg, the best Diesel engines by far are those built by our European allies and by neutrals. Yet, the German Admiralty finds the Diesel engine, even as built by Krupp and by other Teutonic engineers, sufficiently reliable for them to place everything Germany has at stake on the results of its working.

They also find it sufficiently reliable to propel submarines of 1,000 tons to 1,500 tons displacement and of 19 to 21 knots speed for several months continuously without overhaul, and to cruise 1,000 to 1,500 miles, and more, away from their bases. That these Diesel engines are actually doing their work in a thoroughly reliable manner clearly is demonstrated by the steady maintenance of the level of merchant ship attacks, and by the great distance the U-boats regularly operate from their repair bases. After such daily proofs, what shipowner should be nervous of ordering a Diesel engine for one of his ships?

Surface-Ignition Oil-Engines vs. Diesel-Type Engines

A PROMINENT European company building two-cycle Diesel engines has sent us a criticism of the surface-ignition type of marine oil-engine. We always are glad to afford space for discussing engineering features in our columns, so, while we publish these comments we do not necessarily accept responsibility for the opinions expressed. Needless to say our pages are open for publishing replies from manufacturers of surface-ignition types of motors, and we hope that they take up this matter in a vigorous manner. The comments sent us are as follows:

1. Probability of breaking the cylinder heads, which are much exposed to a very high heat.

2. Probability of pre-ignition with heavy loads.

3. Great difficulties in the use of heavy crude-oil, heavier than 0.92 specific weight, such as all the Roumanian oil at low custom duty.

4. To reverse the running direction of the motor it is necessary to put a reversing gear between the propeller-shaft and the motor crank-shaft, which is a complication of the handling device.

5. The guaranteed fuel-consumption of the (we have deleted the name—Ed.) Motor is 260 grammes for b. h. p. plus 10 per cent tolerance, which gives a total fuel-consumption of 286 grammes. This fuel-consumption is very much higher than in any original Diesel-engine, which has an average fuel consumption of only 190 grammes per b. h. p.

6. The pre-ignition reversing is doubtless very unsatisfactory and demands a very skilful machinist in order to give a satisfactory maneuvering of the motor. (Only a few engines of this type have pre-ignition reversing.—Ed.)

7. One maker of this type of engine is using, in spite of a previous assertion to the contrary, also an air-compressor such as with the original Diesel engine.

8. From the photographs it seems that the (we have deleted the name—Ed.) motor is quite complicated. The straight Diesel engine is much more compact which is demonstrated by the fact that it can be operated with liquid fuel at a consumption of 30 per cent less than this motor.

9. This type of engine generally seems to be started with compressed air and in this case certainly it is not much simpler than a straight Diesel engine.

10. The price of a 320 h. p. surface-ignition engine today in America is very little less than that of a true Diesel-type engine, and the latter has the advantage of cross-head and guide construction.

11. Heat of engine-room, particularly in hot climates, due to hot-bulbs and starting torches.

SECRETS OF THE SUBMARINE.

("Secrets of the Submarne," by Marley F. Hay, M. S. N. A., M. I. N. A., published by Dodd, Mead & Co., New York City. Price $1.25).

The publication of Mr. Marley F. Hay's new book recalls to our mind a very sad occurrence that took place before America entered the war and which is not mentioned in Mr. Hay's book. On board the ill-fated liner "Lusitania", which was torpedoed without warning by a submarine, were Mr. A. L. Hopkins, president of the Newport News Shipbuilding & Dry Dock Co., and Mr. Samuel Knox, president of the New York Shipbuilding Co., who were en route to Great Britain for the purpose of acquiring the building rights of the Hay-Denny submarine, a successful type of subseas boat designed by Mr. Marley F. Hay in conjunction with Denny Bros., the well-known Scottish shipbuilders. These two companies, after repeated requests from Secretary Daniels, had decided to take up submarine construction; these men were journeying to Europe to secure what they considered to be the very latest and best in the way of submarine and Diesel engine designs.

Mr. Hopkins lost his life, but Mr. Knox miraculously was rescued after having been carried down in the depths by one of the funnels of the great ship as she keeled over.

The two shipbuilding companies ultimately acquired the rights of the Hay-Denny submarine and of the Werkspoor-Diesel engine, and nearly two years ago both placed bids for the construction of U. S. A. submarines. For some reason or other, however, they did not secure any orders, although the opening of the bids had been delayed several weeks in order to give them time to present their bids. As a result the Hay-Denny submarine still remains unknown to this country. We think we are right, by the way, in saying that Mr. Hay is an American and resides along the Massachusetts coast.

Being a submarine-designer, Mr. Hay is enabled to give some very valuable information in his book concerning submarines, and the same is perfectly understandable by the layman, as the descriptive section is conspicuous by the absence of technicalities. At the same time there is incorporated much information of value to the marine engineer, so that very interesting reading is to be found therein for both classes of readers.

Mr. Hay has devoted 17 years to the designing and construction of submersibles, and the Danish and Dutch Admiralties have adopted his design, while we believe that there are some Hay-Denny submarines in the service of the British Navy.

One of the most interesting chapters of Mr. Hay's book is number eight, which, under the heading of "Submarine Antidotes," deals very intelligently with the various methods of defense against submarine attack. In this he is assisted by his knowledge of exactly what a submarine can and cannot do. Everything he says in this section is exactly in concurrence with the opinions we ourselves formed many months ago, some of which we have expressed in "Motorship", and it is gratifying to have our views endorsed by such a qualified expert.

One of these opinions is that the aeroplane is of little use against the submarine, except when the submarine is on the surface charging batteries or air tanks. Mr. Hay says that "the successful exploits of the German submarines have effectually disposed of the idea that aeroplanes are an efficient defense against them." "Whatever success the Allies have had in destroying the enemy submarines it may safely be said that very little of it has been due to aeroplanes." Mr. Hay gives reasons for these contentions that leave little room for any convincing adverse arguments.

Having read Mr. Hays' book from cover to cover we unhesitatingly recommend his work to all readers of "Motorship." Today the submarine is making history—terrible history, it is true,—but nevertheless history, and it even may break the civilized world. Therefore, every man, and even every woman, should become acquainted with the submarine as now revealed by Mr. Hay. Then there would be fewer foolish stories in the daily press, and we all would be awake to the gravity of the situation, and the worse things that threaten the world in the months to come through the abuse of the use of the submarine.

TEST ON FULTON DIESEL ENGINE.

A fuel consumption test was recently made on a Fulton Diesel engine of 50 h. p. The fuel used was Pennsylvania fuel oil and the consumption worked out at 0.5025 pound per h. p. hour, which is very good results for an engine of such low power.

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Diesel Engine Revolution-Speed and Efficiency

A Discussion on a Subject of Vital Importance to Shipbuilders and Naval Architects

By THOS. ORCHARD LISLE, A. M. I. Mar. E.

NOT a little misconception appears to be prevalent, particularly among our naval-architects, regarding the revolution-speed of the large ocean-going marine Diesel-engine and its effect upon propelling-efficiency compared with the revolution-speed and propulsive-efficiency of a steam-engined ship of similar size and power. This misunderstanding seems to be due mainly to the absence of a deep study of all the conditions and functions pertaining to the operation of big Diesel-driven steel motorships, and to premature conclusions having been drawn without taking into proper consideration certain fundamental features of the internal-combustion-motor that are not to be found with the steam turbine or steam reciprocating-engine. This in turn is due to the lack of American-owned motor vessels of this class from which ship-designers can personally collect the desirable and very necessary records and data.

Unfortunately, with one exception—a U. S. Navy tankship, which is not available for private study—all large motor vessels that come under this heading are foreign-owned and built. Many of them frequently pay brief calls at our ports; but, only on rare occasions are they visited by our naval-architects and shipowners, and even when an inspection is made the time spent aboard is insufficient, also the language of the foreign engineer frequently causes the establishment of misleading impressions in the minds of the visitor, and these impressions once they are fixed are hard to throw off.

Consequently, those men responsible for the ships of this country extract much of their Diesel information from inaccurate articles in semi-technical journals or from the few and incomplete books on Diesel engines, much of which is written without proper knowledge of the subject. Hence, it is little wonder that some remarkable statements or theories occasionally are propounded on this very subject by men whose duty and business is to know better.

The only high-powered marine Diesel engines yet built in this country are those of the naval tanker just referred to, which certainly had too high an engine revolution-speed. But, no sensible naval-architect would base his assumptions on that particular ship, because her motors were designed over five years ago by an inland foreign firm then totally inexperienced with the construction and operation of large ocean-going mercantile-type oil-engines, and it is extremely unlikely that these engines ever will be duplicated. Such marine Diesel engines as have been built in this country and placed in service have been of the moderately high-speed type, and really are little more than glorified submarine engines, being without proper cross-heads and guides, also are of quite moderate power. So, here again such engines should not have been used as a basis for comparing their revolution speeds with the slow speeds of steam-engines of four times the power.

One prominent European company of engineers did equip a ship with a pair of 1,000 i. h. p. Diesel engines that turned at 150 revs. per minute; but, that was their first attempt at such a big task, and they were accustomed to building high-speed submarine motors and to stationary oil-engine work. Their country has no sea-ports or ships. However, they learned their lesson well. Needless to say their next job turned out was of a substantially lower speed: it now propels a British Admiralty oil-tanker.

Possibly, endeavors to make the best possible showing induced some European engineers to design their motors to run at higher revolutions than steam machinery. But, as this result produced engines that weighed from 20% to 50% less than steam-engines and boilers, there would appear to be no logical reasons why Diesel engines cannot be made to give their output at practically the same speed as steam-machinery, provided, of course, shipowners will stand for the extra cost of material and for an increase of fuel-consumption of, say, from the present results of 0.4 lb. per shaft h. p. hour to nearly 0.5 lb. That is, an increase of about 10%. Even the latter may not be necessary, and in one sense is unimportant, because the very best oil-fired steam practice is not under 1.2 lb. per shaft h. p. hour, so the economy still would remain considerably greater in favor of the Diesel engines.

Some marine Diesel engines have been designed to develop their power at 86 r. p. m. but, most of the European mercantile marine Diesel engines of 1,000 i. h. p. per shaft and over develop their maximum rated output at speeds which vary from 90 r. p. m. to 130 r. p. m. according to the ideas of the individual designers and builders, and in actual service average from 5 to 10 revolutions below their maximum rated speed, as no good ship's engineer will run his plant at the fullest continuous load. Consequently the average Diesel engine of 1,500 i. h. p. will run at about 105 r. p. m. day in and day out through storm and calm.

To reduce the propeller speed in such cases by means of reduction-gearing or electrical transmission is inadvisable, because the gain in propeller efficiency would barely make up for the transmission losses.

To illustrate how little known or understood is the real propulsive efficiency of the modern mercantile marine Diesel engine, the following remarks will satisfactorily demonstrate that a twin-screw motorship of a total power equivalent to 3,000 steam i. h. p. has a better all-round propelling-efficiency than a single-screw steamer of the same power and driven by a reciprocating engine turning at lower speed. In each instance the propellers will be direct-coupled. Under all general sea conditions they will maintain speeds of 105 r. p. m. and 85 r. p. m. respectively. At first thought this statement may seem absurd on the face of it, and that the slower turning propeller is bound to produce better results; but, as before mentioned, the matter needs deeper study than the mere drawing of conclusions from surface appearances.

In the first place the steamer will have one large propeller situated in a position where much of its efficiency is lost, owing to it not receiving a complete solid body of water, also the rudder-frame and stern of the ship practically block a portion of its diameter. On the other hand the propellers of the twin-screw motorship will be arranged on either side of the after end of the ship where they will receive an almost unobstructed flow of water.

Secondly, the two Diesel engines will be smaller than a single steam engine of the same power, and will have less piston stroke, so that the shaft-line will be lower down in the hull, and, as the propellers will be smaller in diameter they will not so frequently come out of the water when the stern of the ship is lifting in a heavy sea, hence will be driving for a longer period of time, and not so often wasting energy on the air.

They also will be much more efficient when the ship is running in ballast, because instead of half the blades turning in the air and the other halves churning foam, as will be the propeller of the single-screw steamer, they will be at least completely submerged. (This probably is why many Diesel ships have shown to have almost the same speed loaded as when light in actual service). Now, seeing that the average ship spends about 30% of her time at sea in ballast, this particular item alone will make a vast difference in the average speed for a year's operation.

Thirdly, a single-screw vessel always has a tendency to swing in one direction because of the action of the column of water from the propeller on her rudder and because of the torsion of the propeller. A good helmsman will reduce the material results of this swing to a very low percentage; but, with an indolent or careless helmsman who is slow in correcting the helm the extra distance traveled by the ship in a sort of zig-zag course, be each movement ever so slight, may reach to a considerable mileage in half a dozen voyages, and perhaps be entered in the log as propeller slip. With the twin-screw motorship this drawback is virtually eliminated.

Fourthly, a twin-screw ship is much easier to maneuver in harbor, and during the course of a year this in itself may mean many hours saved. Every hour saved is so much money in the owner's pocket, hence forms a different kind of propeller efficiencies none-the-less valuable, however.

The fifth reason forms the most important of the propeller efficiencies gained by the use of the Diesel engine.

No matter how heavy is the weather, no matter how often the propeller comes out of the water, the modern Diesel engine will not race. A good Diesel engine properly attended to will operate right across the Atlantic through gale and calm with practically no variation in its revolutions. Maybe throughout several days both engines will run at 105 r. p. m., and for the next day or two will run at 104 r. p. m. respectively, or occasionally at 103, and 107 r. p. m. So steady and so regular is this running that one well-known firm of motorship owners do not have governors fitted to the engines of their Diesel ships. Where governors are fitted they rarely are automatically brought into action. When they are used their action is instantaneous, because the shutting off of the fuel immediately slows down the engines.

How different is the case of the steam-engine as all those who have been to sea in the engine-room know full well. How we have to stand at the throttle during a gale watching every movement of the ship! Even when we quickly close the throttle the steam left in the intermediate chambers is sufficient to cause the propellers to race with a "shriek" that threatens to cast a blade or two or break a shaft. Then, when the propeller once more is emerged, the sudden resistance slows the steam-engine down to well below normal speed while the intermediate-chambers are becoming re-charged with steam.

All this erratic propeller-speed with its attendant loss in efficiency, is totally eliminated with Diesel-engines, and this excellent feature alone more than compensates for their higher initial revolution-speed. Diesel-engines have no steam in the intermediate chambers. Every cylinder is individually and instantly controlled, while the high air-compression in each cylinder when fuel is cut off forms an excellent cushioned brake to prevent any propeller racing, as, with a six-cylinder engine this pressure is constant, but not too sudden in action to cause harm. This regular and steady maintenance of revolution speed, day after day, week after week, gives the equivalent of excellent propeller-efficiency to a motorship, for it is a sustained efficiency.

Then again, in the case of a coal-fired steamship even calm weather does not prevent very uneven propeller revolutions, with consequent loss of efficiency; for, we all know how difficult it is to get firemen to maintain an even pressure of steam, and with some of the stokers that are shipped today the chief-engineer considers himself lucky to get any steam-pressure at all. Even with the best of firemen the fires have to be cleaned at certain times with the usual reduction of steam-pressure and the attendant drop in the propeller speed. All these little things may not amount to very much individually; but collectively and spread over a long period mean a great deal to the efficiency of the ship.

The curious part of the whole business is that none of these features would make themselves apparent during brief acceptance trials of two such ships were they run off together. As a matter of fact the single-screw steamer would probably put up a much better showing than a twin-screw Diesel-ship when on trials, (except for economy and cargo-carrying propensities). Where the motor vessel would shine would be over a twelve month's operation for reasons which clearly have been demonstrated, and shows how important it is to closely study the actual operation of big motorships.

[While we think Mr. Lisle has shown in a convincing manner that the twin screw Diesel-engined vessel with its higher propeller speed has a better sustained propulsive-efficiency than a single-screw slow-turning steam-engined ship, we shall be glad to throw open our columns to discussions on the subject, and we hope that many naval-architects will evince sufficient interest in the subject to send along their views and comments.—Editor]

RAPID DIESEL ENGINE CONSTRUCTION.

Seven months after acquiring a Sulzer marine Diesel engine constructional license, Ansaldo & Co., the great Italian shipbuilders, completed and tested a naval-type Diesel engine of 400 b. h. p. They since have started work on many other engines. This record was only beaten by the Werkspoor of Amsterdam seven years ago. The "Vulcanus" a steel-built Diesel ship of 2,080 tons displacement, and of 500 b. h. p. at 174 r. p. m., was designed, built, also the engines were designed and built, engine and ship trials run, in six months from the date of receiving the order. Yet this was the first full-powered ocean-going Diesel motorship ever placed in service.

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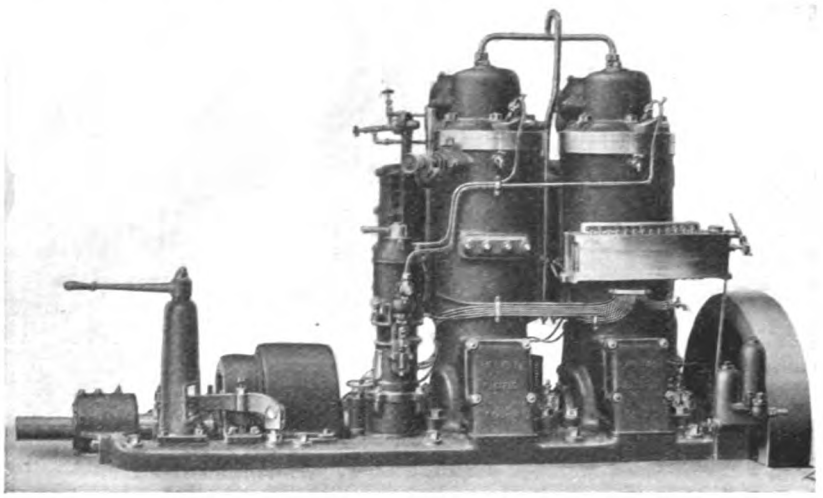
Skandia Pacific Oil Engine Company Puts New Size Engine on the Market

The Skandia Pacific Oil Engine Company of San Francisco noting the steadily increasing demand for oil engines of a suitable size for work boats and small freighters have taken this into consideration and have been working for a number of months on a model which is destined to take its place among similar sized engines of different makes. This engine, which we illustrate, is rated at 38 b. h. p., but in shop tests covering considerable time has generated as high as 46½ b. h .p. for a limited time. It is the plan of the makers to build this type engine in powers ranging from 7 to 180 b. h. p. One installation has been made already—that of the "Skandia Pacific" a tuna fishing boat which has been powered with the model upon which the test was run.



38 B. H. P. SKANDIA ENGINE, SUITABLE FOR FISHING AND SMALL WORK BOATS

The dimensions of this, which are in the metric system, are as follows:

Cylinder—Bore 224 mm., stroke 256 mm.

Main Bearings—Diameter 95 mm., length 128 mm.

Crank Pin Bearings—Diameter 95 mm., length 130 mm.

Crankshaft—Diameter 95 mm.

Wrist Pin Bearing—Diameter 75 mm., length 126 mm., r. p. m. 375.

The engine is equipped with ball-bearing thrust. The weight is 5830 lbs. net.

On a test of over two hours this engine operating on Calol Diesel engine oil, generated 32 b. h. p. at 290 r. p. m., with a fuel consumption of 2½ gallons per hour and a fuel economy of .078 gallons per b. h. p. hour. The engine was then run for one hour and forty-four minutes at 361 r. p. m. generating 40 b. h. p., with the fuel consumption running 2.9 gallons per hour and the fuel economy .072 gallons per b. h. p. hour. In this test the torches were not used after starting and at this horse power the engine was run at a maximum speed for the given load and with the fuel pump adjustment the same as when the test was started.

When the maximum power was reached a knocking was ascertained in the cylinders. After this test the engine was run from 26 to 28 horsepower—the average being 27.1 b. h. p. for one hour: the fuel consumption being 2.30 gallons per hour and the fuel economy .085 per b. h. p. hour.

In the final test the engine was run for forty-five minutes at 14 b. h. p. and at 190 r. p. m. at which time the balls and cylinder heads cooled down and the engine started missing.

Several orders have already been placed for this model in different powers ranging from 7 to 180 h. p.—the largest of these being for fifteen from 9 to 75 h. p., for the Pacific Importing Company of Manila, P. I., and for 48-120 b. h. p. for Christoffer Hannevig.

TUNA-FISHING BOAT EQUIPPED WITH 38 H. P. SKANDIA

A NEW STEEL.

In England a new tool steel has been produced known as "Cobaltcrom Air-Hardening High-Speed Steel," which is said to give equal endurance to the best Tungsten H. S. steel. There also is said to be a complete absence of cracking risks in hardening, and that air hardening is effected at 1,000 degrees Centigrade. Its specific gravity is 10 per cent below that of Tungsten H. S. steel. It is manufactured under license by Darwin & Milner, Ltd., of Sheffield, and by Sybry, Searls & Co., Ltd., of the same city.

UNION GAS ENGINE CO. BUSY.

Besides equipping seven South Sea Island traders with Union gas engines, this company has been busy in supplying engines for a number of smaller vessels. One 225 h. p. engine was installed in the "Rainier" and one 125 h. p. engine in the "Sentinel." Both of these vessels were for the U. S. Navy. The "Alsaco," a codfish schooner, has been equipped with a 80 h. p. Union engine, seven large San Francisco tugboats have installed these engines, five of 110 h. p. About a hundred small boats have installed the Union during the past season.

DIESEL ENGINE CONSTRUCTION IN SWITZERLAND.

During the war vast progress has been made with the construction of naval marine type Diesel oil-engines at the works of Sulzer Freres, Winterthur, Switzerland, and before long readers of "Motorship" can look forward to having full details and illustrations placed before them. Up to today Sulzer Freres and their constructional licensees have completed and placed in service no less than 75,000 b. h. p. in marine Diesel engines, and 100,000 b. h. p. in stationary Diesel engines. At present day prices in America this would represent a monetary value of over twenty million dollars, indicating how important the Diesel engine industry has become,—and this is in an inland country where there is no natural oil supply, and not a single sea-port, or ships other than small lake vessels.

Sulzers have installed two six-cylinder Diesel engines, 30" bore, developing 4,000 b. h. p., one of which operates 12 hours per day, every day in the year, at the dry dock of Harland & Wolff, Belfast.

From a single-acting, 40-inch bore, single-cylinder engine of the two-cycle Diesel type they have obtained as much as 2,100 b. h. p. without cracking the cylinder head. If they ever build a six-cylinder engine of this dimension it will mean possible at least 12,000 b. h. p. (15,000 i. h. p.) per shaft, or say, 45,000 i. h. p. for a triple-screw ship. Seeing that this single-cylinder motor has been satisfactorily run at intervals during the last four years the motor-driven liner and the motor-driven battleship does not seem to be such a long way off and would seem to rest with the courage of some Government or steamship company to risk the enormous cost for such an experiment. The builders have done their share at their own expense.

Sulzers also have made some very successful experiments with a super-Diesel type of engine, using unusually high pressures in the cylinder and for fuel injection.

A PLEASANT FEATURE OF MOTORSHIP—THE ROSY OUTLOOK!

Readers of this journal doubtless will have noticed the large proportion of articles which are to be found only in "Motorship." For, our editorial policy includes the avoidance of syndicated matter—at least, as far as is possible. This excellent feature of "Motorship" we hope our readers appreciate. It must be quite a mental relief to pick up this publication and find that it rarely contains articles that the reader has seen several days, or weeks, previously in several other magazines. There now are under special preparation for "Motorship," by men of high repute in the marine engineering world, some interesting and valuable articles. Many times we have been paid high compliments over our past editorial features; but, we can promise that each future issue will excel all previous numbers. We take the opportunity to thank those of our readers who very kindly have recommended the journal to their friends. Purely on its own merits Motorship has made a headway beyond all expectations for the short period since its inception. Subscriptions are now coming from abroad with every mail, while domestic subscribers roll along daily. Every indication goes to show that before another year Motorship will have a paid subscription circulation larger than that of any other domestic commercial-marine journal—a very gratifying outlook, which by the way, also is a forecast of a coming great development of the motorshipping industry in the United States.

LONG DISTANCE CRUISES OF SUBMARINES.

The visit some time ago of two German submarines—one a freighter and one a U-boat,—caused considerable comment. In the past, however, submarines have made long journeys. About five years ago two British submarines cruised under convoy to Australia from England. In 1912 the French submarine "Farady" cruised from Rocheport to Toulon, a distance of 1730 miles, averaging a speed of 11 knots, notwithstanding two days of really bad weather. She did not make any call en route and was not convoyed. The Greek submarine "Delphin" cruised from Toulon to Piraeus, or 1100 miles at 9½ knots speed without an escort. The submarine "Papin" cruised from Cherbourg to Bizerta, of which voyage the 1230 miles from Rocheport to Oran was made in 6 days, averaging 9 knots. This was in October, 1909, or eight years ago, which really is remarkable for those days. In July, 1912, the "Brumaire" made an 800-mile cruise in 72 hours. In 1916, ten small American-built submarines cruised to Europe under their own power and under escort, averaging 9 knots speed.

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Heavy Oil-Engine Facts and Fallacies

By Reginald W. Crowly.

[EDITORIAL NOTE—*The following article is an extract from an article in "The Automobile" of New York. Owing to lack of space we are unable to reproduce it in full, but such as we do print is of very great interest*].

IN answer to an economic law the oil-burning engine was developed abroad and not here. By the progressive operation of that law in this country, the oil-burning engine had to be introduced here. By a phenomenal operation of the same law, the oil-burning engine has boomed here. The normal operation of that law will probably hold it here. But another law, the law of unrestrained capacity and greed, has upset the smoothness of the new industrial movement which sprang from the oil-burning engine. This phase will pass; the people will learn, and the oil-burning engine will come into its own.

Let caution be the slogan! The recklessness of ignorance and a lack of engineering imagination have scarred this new industrial movement. An oil-burning engine is not merely a gas engine with oil squirted into it.

The only market that has yet clearly shown its power of absorption is that of auxiliary ships. And this is where caution has most flagrantly been despised. Men have bought even engines on paper, engines never built, engines only dreamt. Almost anything that looks like an engine, or may be interpreted to look like an engine, has a market price and can be sold. Promise of rapid delivery is the only essential. And not only engine builders have made and sold rash promises, but jobbers, merchants and agents have built on these rash promises like towers on quickstand, and many an ultimate owner has a deal to rue.

This market for auxiliary engines demands units between 120 h. p. and 350 h. p. Its value has run into perhaps $15,000,000 during the last couple of years. Prices have grown up and up until they have touched $140 per horsepower in trustworthy engines.

Five years ago in this country the makers of engines that could be claimed to burn oil did not require to be counted; there were not six. Five years ago, a number of manufacturers went into the business. Why? Because in the previous year or two there had been an increasing volume of publicity given to the oil-burning engine by the technical organs of this country, culminating in the indisputable demonstration of the success of the big engine afforded by the first ocean-going motorship. And that supervened upon the lapse of the Diesel engine patent claims here. The way seemed to stand open to an immediate participation in a new sphere of industry full of future promise. What was good for the big ship would be good for all craft, it seemed.

Yet European development was not ripe, and that fact was not known nor suspected here. All the efforts of many years in the different countries of Europe had merely brought the oil-burning engine to the verge of real development. European manufacturers were then passing through the maze in which the American manufacturers have spent the last 5 years. It was still to be demonstrated beyond all cavil that many Diesel engines were doomed to failure from the outset, that others could be made successful only after long trial. It was still to be shown that the simpler-looking hot-bulb engine, misnamed a semi-Diesel engine, held problems enough to baffle mediocre efforts. Only the advent of the war hid German engineers from the full exposure of the most amazing series of engineering blunders that the whole industry has known. Only the lack of a larger market saved the English engineers from exposing their blunders on a smaller scale in the hot-bulb engine domain.

Is it a matter for wonder that American engineers advancing all unsuspectingly into this field were also beaten at the start? Is it surprising that the failure of American submarine engines became a byword in the world? Is it difficult to understand why the Diesel-type engine first and then the hot-bulb engine were marked down here as failures and were resting under that curse until the blithe pioneers of the Pacific Coast rescued them and by an amazing turn of luck restored them to a favor from which they are again falling?

The hot-bulb engine is very well suited to the general demand of the world, and particularly well suited to the demand in this country. It is very simple, but not yet foolproof. It can be built in any modern shop, with due regard to its particular exactions of workmanship. It can be operated by the ordinary type of engine operator and even by a moderately intelligent man who has substantially no knowledge of engines, but it cannot be operated by a fool. It can be built at a price enabling it to be sold without too much difficulty and giving it the opportunity of a fairly large market. It can burn kerosene, gas-oil or a really light fuel-oil—not heavier than say 30 deg. Baume. And when not fooled with nor abused it is a reliable engine. That is the type at its best.

REGINALD W. CROWLY

The hot-bulb engine has climbed to 500 h. p. and over with success. But here is the rub. Hot-bulb engines are of many different grades. Some are good, some are bad, some are modern, some are old, some even are hot-bulb engines only by virtue of the name given to them by their manufacturers. How can one distinguish between them?

Well, experience alone can sort them all out. But judgment, careful and cautious, and, of course, a little experience, can weed out a goodly number of the poor ones. Some general observations also can be made for useful guidance. In the first place, always mistrust—this is not synonymous with "condemn"—a new design, for in no branch of internal-combustion-engineering can one follow the book so little, or is one required so much to be directed by experiment as in the building of hot-bulb engines. In the second place, do not credit a new engine with assured success merely because it is the copy of a well tried and well proved engine. Thirdly, do not pass over an engine of small reputation merely because it is the product of a small shop—it may be the fruit of several years' clever labor by a man of poor business ability. In sum, these three observations have a common source, viz., that it is experience which counts and the reason therefor can be told.

In the hot-bulb engine a fuel is used which is not volatile at any natural atmosphere temperature, which is not easily forced into admixture with air in a combustible form and which readily reverts from an atomized condition into the condensed form. The ignition depends upon a combination of the temperature due to compression and the temperature superadded by the interior surface of the hot-bulb. How will you design the bulb to attain the object in view? How will you meet the conditions of varying loads? Let us see a few of the disturbing factors that may arise, and then we shall know why so many manufacturers have failed to turn out a dependable hot-bulb engine.

It may be premised that in respect of ignition the Diesel-type engine presents no difficulties, because the ignition is governed wholly by the heat of the compression, and so long as the oil does not enter in a stream so surely will firing take place. The troubles with Diesel engines are not of this order. With the hot-bulb engine, at an assumed constant load, all will be well if the combination of the pump pressure and the spray nozzle cause the fuel to be so broken-up that the heat of the combustion chamber and of all or part of its surface will produce and maintain an inflammation enabling the fuel to completely burn in the turbulent mixture which by some manner or means must be produced. If the spraying is not sufficiently fine to enable the minute particles of oil to burn completely during the short stroke of the piston then there will be sooting.

If the turbulence is not great enough to permit each minute particle of fuel to have air sufficient for combustion then there will be sooting. Remember that the mixture can in this type of engine—to avoid pre-ignition—not be made until just prior to top dead center, and whether it can be made either wholly or partly prior thereto depends upon the bulb, upon the combustion chamber as a whole, upon the temperature in both, upon the rate of mixture between fuel and air, upon the degree of fineness of subdivision of the fuel produced by the injection, and upon the nature of the fuel itself. To continue again the possibilities of trouble, if the heat of the bulb be insufficient, then either ignition will be late and there will be sooting, or ignition will fail. Any sooting will finally arrest the operation of the engine because according to the nature of its cause it will either choke the injection, prevent the mixture forming or produce pre-ignitions.

Then when the balance of all factors has been found at one load, the balance is far from having been found at all loads. The load variations mean temperature variation, and that varies ignition. When water-injection or water-drip was in fashion the control of the temperature within the combustion chamber was easy, but buyers did not want to be bothered with the water regulation or with any water at all inside the cylinder, and that has had to be relegated to the limbo of hateful devices. Other means have had to be devised—and, sad to relate, because these other means have not been properly devised on many engines, so do many engines fail in practice.

In general, it may be stated that the manufacturers here have not succeeded in producing really satisfactory hot-bulb engines. Even an old firm or two which have made many small engines have not achieved in the large engine what can be called success. They have failed to appreciate the problems they have faced—they have depreciated their task.

It is not surprising that the upstart firms and small shops have failed, but it does awaken wonder that firms associated with the very largest corporations in the country have followed the same way. On every hand the difficulties of the problems seem to have been woefully scorned. There is clear circumstantial evidence that many have thought a hot-bulb and a fuel-pump of practically any shape, form or design would perform the service. Particularly on the Pacific Coast, where boundless confidence always rules, does this thought seem to prevail, but the Middle West and the East have been infected in the same way.

Perhaps I am too exacting. My standard is the best. Evidently, however, it is not too high a

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standard, because one American firm has my full confidence. I exclude imported engines, although as a matter of act only one of the imported engines is worthy of full rank. Yet even if my standard be deemed too exacting, then at least I can wipe out whole rows of engines as being rankly unsatisfactory, leaving only a few passable ones.

There is today a big significance in the multitude of new devices that are being added to the hot-bulb engines by various manufacturers and in the numerous variations being made in this type of engine. I do not pass judgment on the actual practical merit of these changes, because they are yet too new. Some of these engines that are appearing are no longer hot-bulb engines, nor really can they be covered by the broader classification of "surface ignition" engines. The bulbs have made way before rods, tubes, spoons, piston caps and such forms of highly heated devices within the combustion chamber. In other designs again the use of electricity has been called into play, sometimes for merely heating the ignition surface, sometimes for ignition by direct spark. This promises progress. The great criticism against the hot-bulb engine today is the bother of its blow torch.

Another plentiful cause of erratic behavior in even the very good engines is the widespread claim that any fuel can be burned. It is indeed true that these good engines will for a time consume any sort of vile fuel, and in the hands of the skilled operators in the factory they can be made to run for very long periods on a dirty unsuitable fuel. In independent service, however, the engines soon balk at this. Actually, some manufacturers seem thoroughly convinced that any fuel is suitable. They mislead themselves by shop results, and however capable they may be in other respects, they betray a woeful lack of understanding in this regard. They never see their engines in outside service, and regard all reported troubles as arising from the employment of fool operators. They cannot appreciate that most of the engine operators on small engines are virtually fools—they ought to provide against that.

When therefore the previously dwindling wooden shipbuilding industry became awakened to the fact that it was to have a new lease of life because wooden ships would everywhere be deemed better than none at all, the oil-engined schooner was adopted as a type that might enable the wooden vessel to compete afresh with the steel ship when normal times should return.

That started the stampede. Oil-burning engines were not really a market product then. Today they are. And the call of the Pacific Coast for oil engines has stimulated the same call all over the country. The New England fishing industry, conservative in the extreme, is falling into line with the demands of the new shipbuilding industries, now spread to the South, and now also crowding the old industry of Maine and Massachusetts. The revival, or rather the modernization, of the Mississippi River navigation has helped. Everywhere the commercial boat owner is today calling for an engine that will burn oil.

SUBMARINE PATROL.

During the first five months the U. S. torpedo-boat destroyers in the war zone, according to a report issued to the press by Washington, collectively cruised 875,000 miles while submarine patrolling, and that roughly they have spent five-eighths of their time at sea. The boat stayed out at sea five or six days and then put in port for three days.

Surely it hardly is wise to have given out these figures as from them it is comparatively easy to work out approximately the number of U. S. A. destroyers in the war zone, which information we presume the Navy Department desires to keep from Germany?

MOTORSHIP ENGINEERS.

Shipowners desiring motorship engineers should communicate with The Ocean Association of Marine Engineers, 11 Broadway, New York, who recently have opened up an office in the Parkway building, Broad and Cherry streets, Philadelphia.

TWO LARGE STEEL AUXILIARIES.

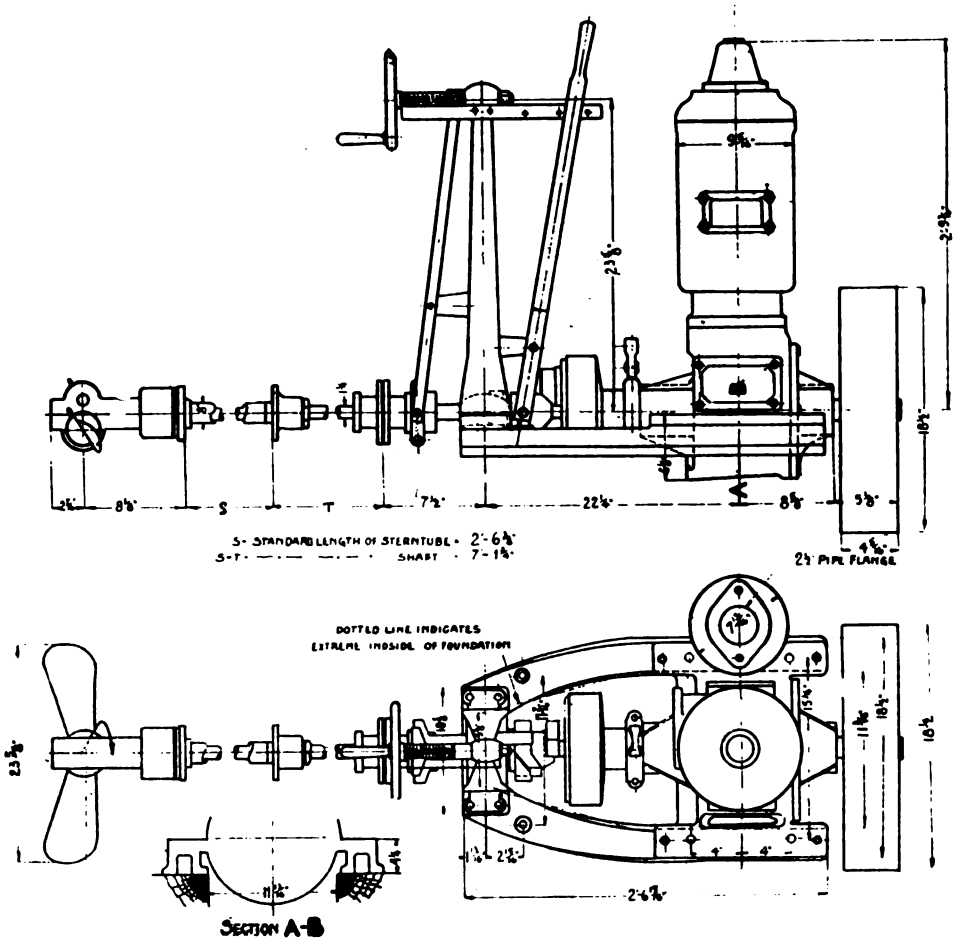
By the time this appears in print there will have been laid down two steel built sea-going six-masted auxiliary schooners for the Aluminum Co., of America, both of which are to be installed with two McIntosh & Seymour, 500 b. h. p. Diesel type oil-engines. The vessels will be 350 ft. long over all, and each will have a d. w. c. of 3,500 tons on 16 ft. draught.

The "Grei" Oil Engine

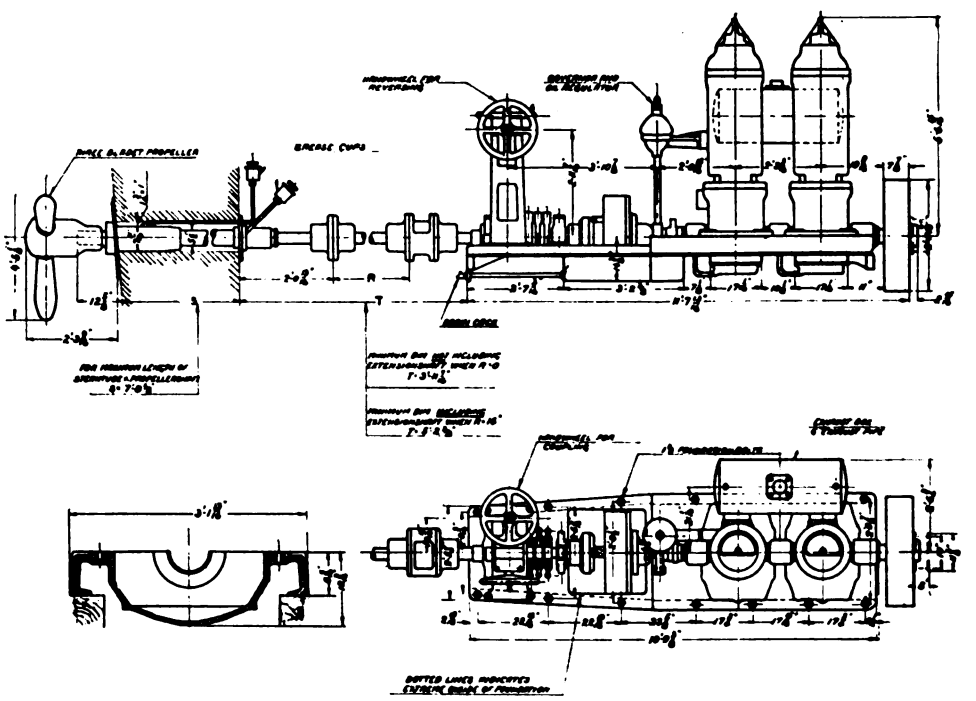
EUROPEAN manufacturers of oil engines are fully alive to the possibilities which will exist in the United States after the war for extending their business. They realize that keen competition will arise in American markets and are sparing no efforts to put their names before American shipowners. One of the first to realize the advantage of coming in on the ground floor is the A. Gulowsen A/S of Christiania, Norway, one of the oldest and most successful builders of heavy oil engines in Europe. This company has shown great enterprise by getting out a catalog printed in English for the benefit of American buyers. This is put together in a most attractive fashion and gives illustrations and complete descriptions of the different sizes and their weights. The trade name of the engine they manufacture is the "Grei" and it is the claim of the makers that wherever this engine has been exhibited it has always been awarded the "Grand Prix."

The "Grei" engines are built in two types: Type G, a heavily-built and slow-running model, and Type H, one of medium weight and of moderate speed. The engines of type G are constructed so as to burn crude oil of specific gravity varying from 80° to 90°, and those of type H to burn paraffin. Both types are built to the rules of the Norwegian Veritas and Lloyds and fulfill all requirements.

The engines are of the vertical two-cycle surface-ignition type and run in powers from 4 to 250 b. h. p. The sizes from 4 to 130 b. h. p. are double-cylindered and their net weights range from 204 to 6,500 kilograms. The two larger sizes, 175 and 250 b. h. p., are four-cylindered and are direct-reversible, using compressed air. The smallest size is called the "Littlegrei." It is the type used in lifeboats. With the exception of the last named all the other sizes work with and without water inlet, developing the greatest powers when the water inlet system is in use and vice versa.



"GREI" ENGINE, 7-8 H. P.



"GREI" ENGINE, 84-100 H. P.

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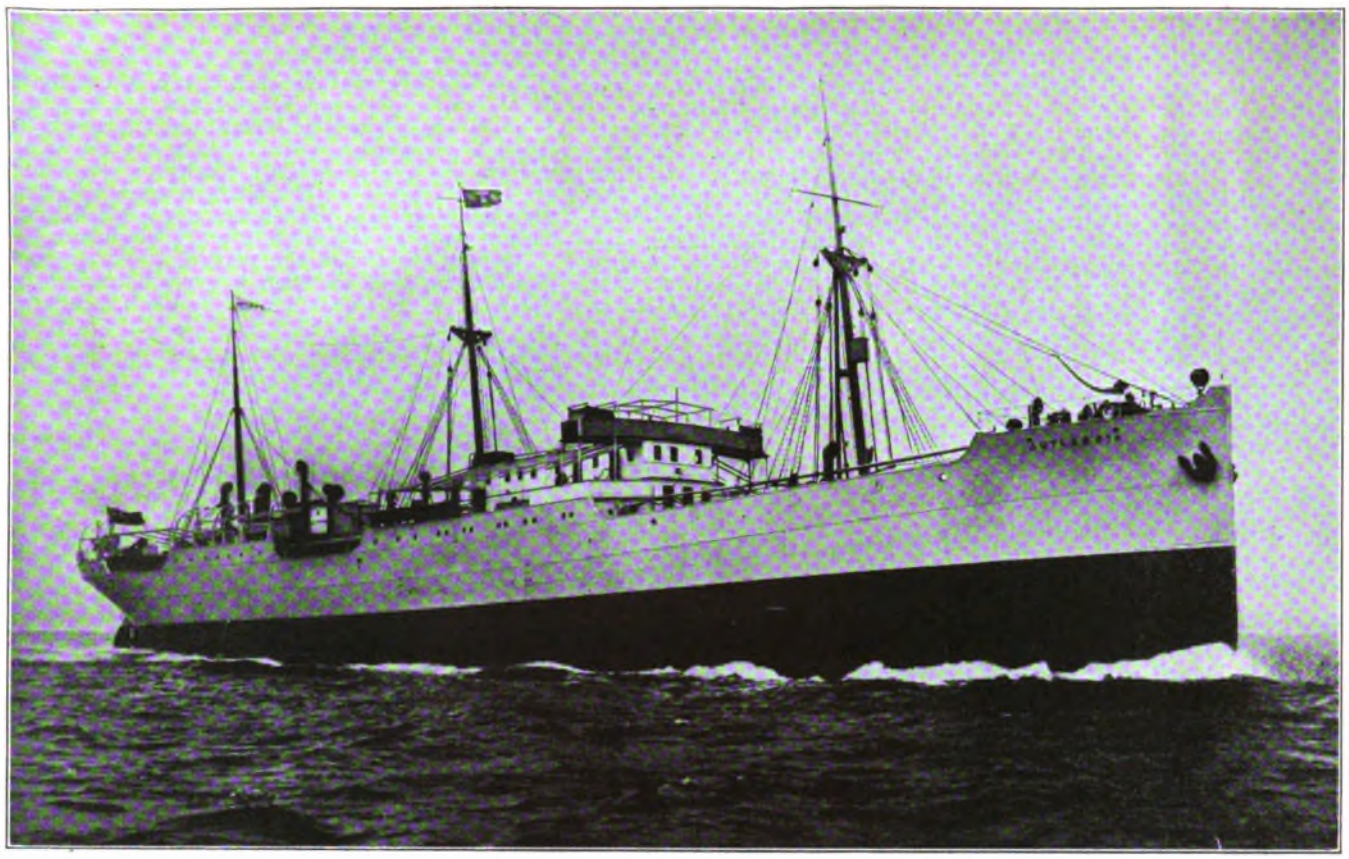

—Photo courtesy of "Shipping" N. Y. C.

The Motorship "Jutlandia"

IF ONLY AMERICA POSSESSED A THOUSAND SHIPS LIKE THIS ONE—THEN HER MARITIME SUPREMACY WOULD NO LONGER BE BUT A DREAM. THIS IS THE "JUTLANDIA," A BIG DIESEL-DRIVEN SHIP BUILT IN GREAT BRITAIN FIVE YEARS AGO

Some of the advantages claimed by the makers for this engine are:

Owing to the special construction of the combustion chamber the engine will run without the use of the hot bulb for any length of time and with any load.

No water drip or air injection is used on normal power or when the engine is running without a load. These advantages are obtained without the use of air compressors and other complicated arrangements.

Being heavily built, slow-running, and of simple design, they have the advantage over the light high-speed engines in greater efficiency, more safety, and in insuring that every part of the engine is doing its work.

The "Grei" engines, type G, are fitted with a centrifugal governor, which insures steady running on any load, as the governor automatically regulates the fuel consumption according to the power developed.

We are reproducing one of the smaller and one of the larger sizes. From these reproductions a very clear idea of the engine can be obtained.

GOOD PERFORMANCE BY AN AUXILIARY.

The main idea of auxiliary motor power for sailing vessels is to drive them in calms, against adverse winds, and when going in and out of harbors; but many auxiliary shipowners want to use the engines all the time. The new auxiliary wooden ship "Geraldine Wolvin", a Canadian-built vessel equipped with a Swedish-constructed Bolinder surface-ignition oil engine, made her maiden voyage from Vancouver, B. C., to the southern end of the New Caledonia, an island in the Southern Pacific Ocean, in thirty-five days. Her motors were used practically the whole distance. She then proceeded to Sydney, N. S. W., arriving there 48 days out from Vancouver—and there are some shipowners who recently claimed to "Motorship" that oil-engined auxiliaries are a failure!

PACIFIC COAST McINTOSH AND SEYMOUR REPRESENTATIVE.

The McIntosh & Seymour Corporation wish to announce that on account of the present unusual demand for marine equipment that it has decided to transfer C. G. Cox, their present central district manager, to the Pacific Coast, and to close his office in St. Louis temporarily. Mr. Cox will now make his headquarters in Portland and San Francisco.

Convincing Proof for the United States Shipping Board

What could be more convincing proof of the success of Diesel-driven ocean motorships for the U. S. Shipping Board and for American shipowners than the statements recently made in London by Sir Marcus Samuel. This well-known shipowner has too many important interests in oil-fired steamers to boost motorships unless he was absolutely satisfied that the time has come to openly recognize the success and superiority of the new class of ship, even at the expense of being obliged to ultimately "scrap" existing machinery.

If what Sir Marcus says is true, which it obviously is, then there is no longer any legitimate reason for further delay or hesitation on the part of those men responsible for the building of America's new merchant marine, and arrangements should be made at once for the building of a number of motor-vessels. Already there is difficulty in securing sufficient steam-engines, boilers, condensers, etc., for steam-driven craft now on order, so it will cause no serious delay to change at least some of them to Diesel-power, and the delay, if any, will more than be made up by the extra carrying-capacity of the motorships, the time saved in bunkering, and by a reduction in the number of sinkings, because of the comparative low visibility of the Diesel-driven vesse'—a camouflaged motorship requiring more than ordinary keenness of perception on the part of submarine commanders.

Sir Marcus Samuel, among other important positions, is the chairman of a company formed before the war to give motorships a thorough tryout, and all three of those ships were built and engined by British shipbuilders working under license from European Diesel-constructors, and in one instance it was their first job of the kind.

Unfortunately in the early days of the war, before cargo-shipping became scarce, they were placed on patrol duty in the submarine-infested North Sea, and two were mined or torpedoed.

But, Sir Marcus says that "these three ships have established beyond doubt that the internal-combustion-engine possessed advantages of the most material kind over the steam-engine, and that the remaining ship is doing splendid work maintaining a speed much beyond the contract rate." We have yet to see the steamship that maintains a much better speed than the contract speed under the present extraordinary conditions, when ships are worked to the limit without proper overhaul.

It is also important to note that because of the greater efficiency of these motorships the British Controller of shipping allowed their owners about 12 per cent better freight rates.

It may be said,—then, why does not Great Britain build motorships? Great Britain is building some motorships and more will be built if she finds crude-oil at home.

But, that England's ships should mostly be coal-driven at the present time will be understood when one stops to remember that she is the greatest of all steamship-coal producing countries and has coaling stations all over the world. On the other hand she is very hard put-to for oil-fuel, having but little domestic oil and there is a great shortage of oil-carrying tankships.

However, we can rest assured that had Great Britain the same wonderful natural supply of oil-fuel possessed by America, every single merchant ship laid down today would be equipped with motor power.

Whereas, at the present time she has great difficulty in obtaining sufficient oil-fuel. The news has just reached us that the new American built Cunarders "War Victory" and "War Viceroy" have had to be changed from oil-burning to coal-burning for this very reason, although on trials with oil-fuel very satisfactory speed results were obtained. It also is said that the S. S. "Landaas" now being built will be changed to coal. Had these vessels been fitted with Diesel-engines this change would not have been necessary, as their consumption of oil-fuel would have been so exceedingly low.

MOTORSHIP PROFITS.

The East Asiatic Company, who own 16 motorships totalling 116,352 tons d. w. c., and who have 22 additional Diesel-driven motorships on order, made a gross profit on their ships for 1916 of 21,247,195 Kroners ($6,374,158). Their other trading enterprises brought this up to 47,832,118 Kroners. A dividend of 45% was paid. As this company owns no steamers, it is obvious that were their motorships unreliable, or a failure, their profits would have been conspicuous by their absence.

PROMINENT DIESEL-ENGINE DEVELOPER DEAD.

It is with considerable regret we learn of the death of Sir Wm. Theodore Doxford, Kt., of the shipbuilding and engineering firm of Doxford & Co., Ltd., Sunderland, England. This company under the guidance of Sir William was prominent in the development of the marine oil-engine in Great Britain. In the June issue of "Motorship" a complete story was given regarding what was done by them in this direction. An idea of the output of Doxford & Co., will be understood when we say that in 1896 they built 25 steel vessels aggregating 106,058 tons. We have no later records, but the previous year Doxford's turned out 20 vessels of 86,632 tons.

Sir Theodore, while working with a large degree of originative ability and high rectitude of character for the advancement of the firm which was founded by his father 76 years ago, exercised an important influence on the public life of the community, devoting his spare time to problems of local and imperial government. Like other men gifted with keen perception and foresight he was a firm believer in the marine internal-combustion oil motor and demonstrated his belief in a substantial manner. His title lapsed with his death.

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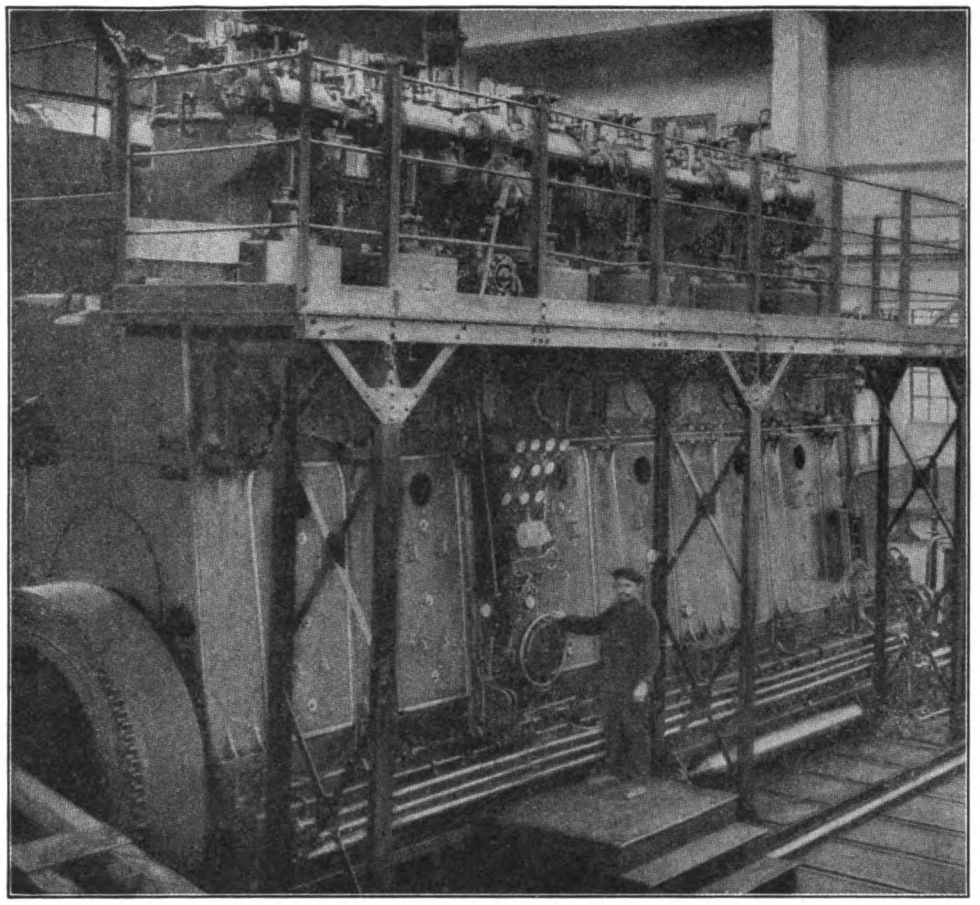
The Diesel-Driven Submarine Mother Ship "Ceara"



ONE OF THE TWO 2200 B. H. P. (3200 I. H. P.) FIAT-DIESEL ENGINES OF THE "CEARA"

WE are enabled to give in this issue some additional illustrations of the Diesel-driven submarine mother ship "Ceara," which we described in our issue of September last. Her twin Diesel motors, say the Fiat-San Giorgio, Ltd., who are completely responsible for her inception, design, and construction, each are capable of developing 2,200 b. h. p. to 2,350 b. h. p. from six cylinders 24.8 inches bore by 35.4 inches stroke at 130 r. p. m.

We gave the displacement of this ship as 4,200 metric tons, but with a complete submarine in her hold and all fuel and stores aboard, her displacement is 6,480 tons. We also mentioned that the scavenging-pump was formed by an enlargement of the lower piston, known as the step-piston design.

Although step-pistons were a feature of earlier Fiat engines, they were not used in this case, in fact the Fiat-San Giorgio, Ltd., has abandoned this principle, and the engines of the "Ceara" have the scavenging-pumps arranged at the back and are operated by beam-lever motion off the crossheads, while the air-compressor is at the forward end and driven off an extension of the crankshaft.

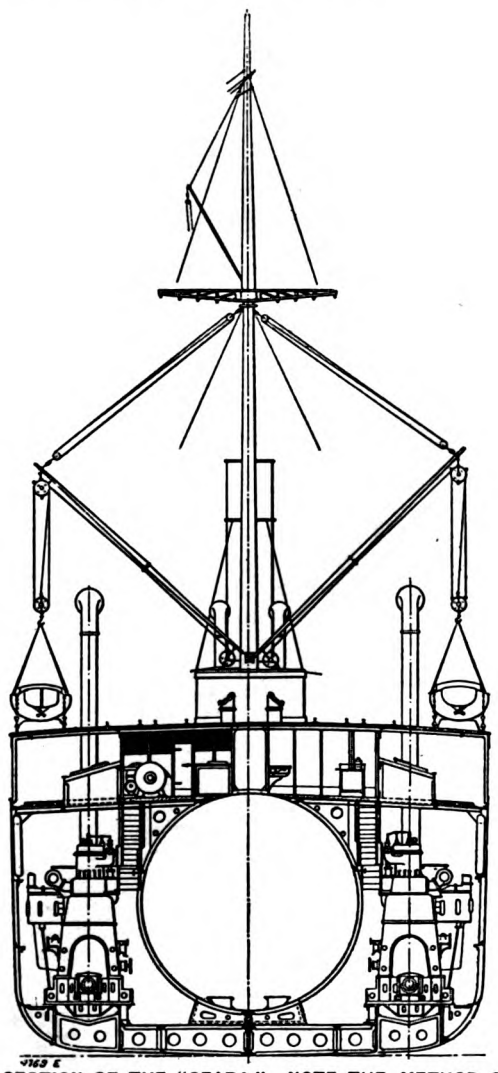
Port scavenging has been adopted so there are only two valves in the cylinder head, namely the fuel-injection valve and the air-starting valve. The voyage from Spezia, Italy, to Rio de Janeiro, Brazil, was accomplished without incident or mishap.

A LARGE SAILING-SHIP FLEET.

The well-known company of shipowners operating from New York City has eighteen sailing ships in service, many running in the South American trade, on which route auxiliary power is most desirable. As motor power properly installed would nearly double the annual carrying capacity of these ships, would it not be advisable for the Government to insist upon its installation as soon as possible in all the sailing ships of this fleet that are strong enough to take such machinery? Apparently the owners do not seem to appreciate the value of marine oil-engines for auxiliary power. We suggest that the Shipping Board make an investigation in order to ascertain the best possible course.

FOR SALE

Wolverine, 75 h. p. engine with air starter. Used only three months. Fuel—Kerosene, Gasoline or Producer Gas. Opportunity to purchase practically new engine. E. J. Morse, 61 Broadway, New York.



SECTION OF THE "CEARA." NOTE THE METHOD OF LAUNCHING THE SMALL MOTORBOATS

NEW DUTCH MOTORSHIP.

Messrs. J. & H. Smit of Kinderdjik, Holland, have laid the keel of a twin-screw motor-driven cargo-ship of 6,500 tons d. w. c. Two Werkspoor-Diesel four-cycle type engines aggregating 2,800 i. h. p. will be installed.

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Large American-Designed Motorships for Russia

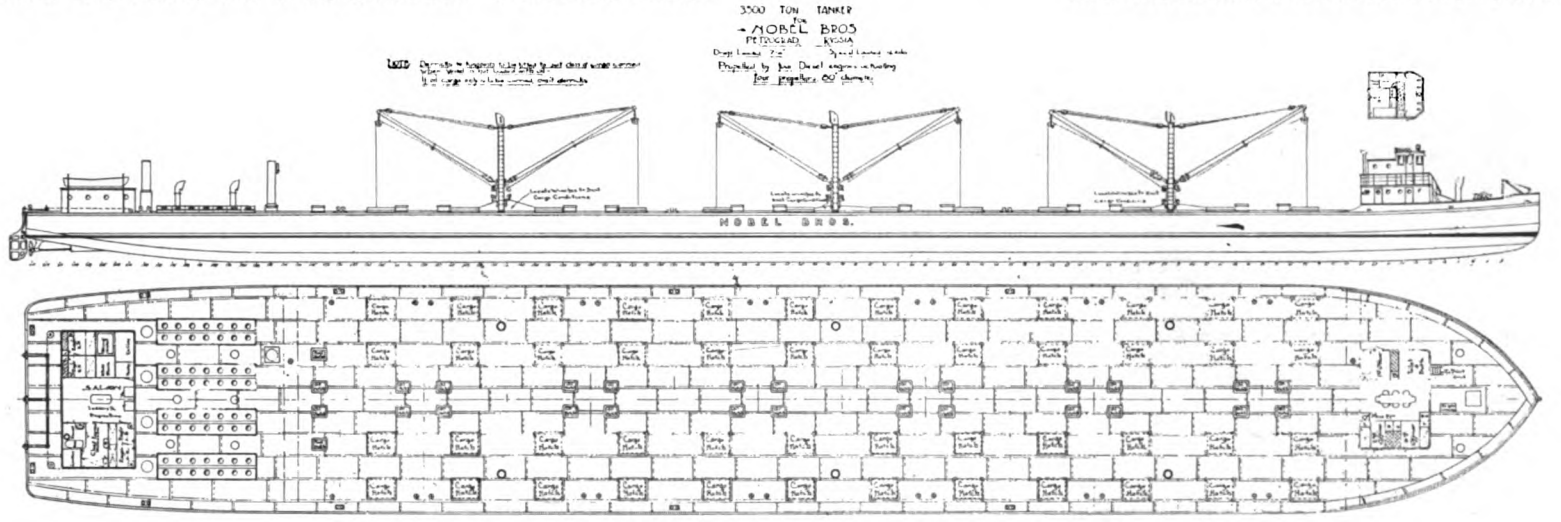
Some New 11-12 Knot Diesel-Driven Freighters and Tenders for the Volga River Service

Considerable additions are being made to the great Diesel-driven motorship fleet of the Nobel Bros. Naphtha Production Company in Russia, this great oil concern now being engaged in building a number of new quadruple-screw freighters and tankers for an increase of their service on the Volga River. When these vessels are completed it will leave no doubt but that Nobels will have the greatest motorship fleet in the world, as they already own a very great number of Diesel-propelled vessels. This is important, as Nobels openly avow that they owe their independence in the oil world principally to wonderful economies in transportation effected by the use of the marine internal combustion oil-engine.

To American readers, however, possibly the most interesting feature of this new fleet is that Nobels came to the United States for the designs of these vessels, having placed the order for the plans last spring with Mr. J. Murray Watts, a Philadelphian naval architect. The hulls and engines are being built in Nobels' own shipyards and Diesel-engine works, where many a notable motorship previously had been constructed; some—vessels of over 4,000 tons d. w. c.—years before Diesel motorships were thought possible in the United States, their first triple-screw tanker having been placed in service in 1903. Russian engineers not only appear to be very clever but have considerable development ability and foresight.

Two sizes of ships have been designed for Nobels by Mr. Watts and in each instance interesting problems arose, for, with the larger of the two sizes of vessels, the deepest draft of craft that can be utilized in certain reaches of the Volga is seven feet, while the others, which will have to navigate the shallow tributaries of the upper Volga are limited to five feet draft when loaded.

The operation of the Nobel motorships is unusually severe, as, similar to the Great Lakes' ships ice preventing navigation for about half the year; so, during the warm weather the motorship fleets are worked incessantly, no stopping for proper machinery repairs, hence in case of accident only temporary adjustments are made, the proper repairs having to wait until the ice sets in. Thus neither men nor metals are spared. This, of course, forms severe grueling for the machinery and it is pleasant to know that the Diesel oil-engine emerges A1 through these hard duties and services. The distance of the return voyage that these new vessels will have to make is about 3,000 miles.



DECK PLAN AND ELEVATION OF THE 3500-TON VOLGA RIVER FREIGHTER

The larger of the Watts' boats have the following dimensions:

Length—432′ 0″
Breadth—64′ 0″
Depth—14′ 0″
Draught—7′ 0″
Cargo capacity—3,500 tons bulk oil
Fuel capacity—50 tons
Horse-power—3,000
Speed (loaded)—12 m. p. h.
Speed (light)—14 m. p. h.

The main propelling machinery will consist of four direct-reversible Nobel-Diesel engines (presumably of the four-cycle type similar to most other Nobel motors) each of 750 h. p. Each of these drives a three-bladed bronze propeller at 225 revolutions per minute. There are three rudders hung outboard, actuated by a Dake steering-engine aft, but controlled from the pilot-house forward.

Besides the oil-hatches leading into the expansion-trunk amid-ships there are two rows of hatches on either side, opening into the space above the oil-carrying double-bottom, and this space is used for miscellaneous cargo on the return voyage. The vessels will run from the oil fields up the Volga river to various discharging stations and oil refineries, making a run (one way) of about 1,500 miles. On the return trip the cargo oil-tanks will be empty, when the old space above these tanks will be utilized for miscellaneous freight as just referred to. These vessels are equipped with six king-posts, three on each side, and cargo-booms handled by oil-engine driven winches. Excellent accommodations are provided for the crew, the engineers being berthed in the deck-house aft; the navigating officers in the deck-house forward, and the crew in the forecastle.

As previously stated in this article the smaller series of Watts-designed vessels are even of less draft. These, however, do not carry oil in bulk, but in barrels in a large cargo-box on the main deck. The oil is brought from the oil-fields to the main distributing centers on the trip up river, and lumber or other bulk cargo is loaded into the cargo-box for the return trip.

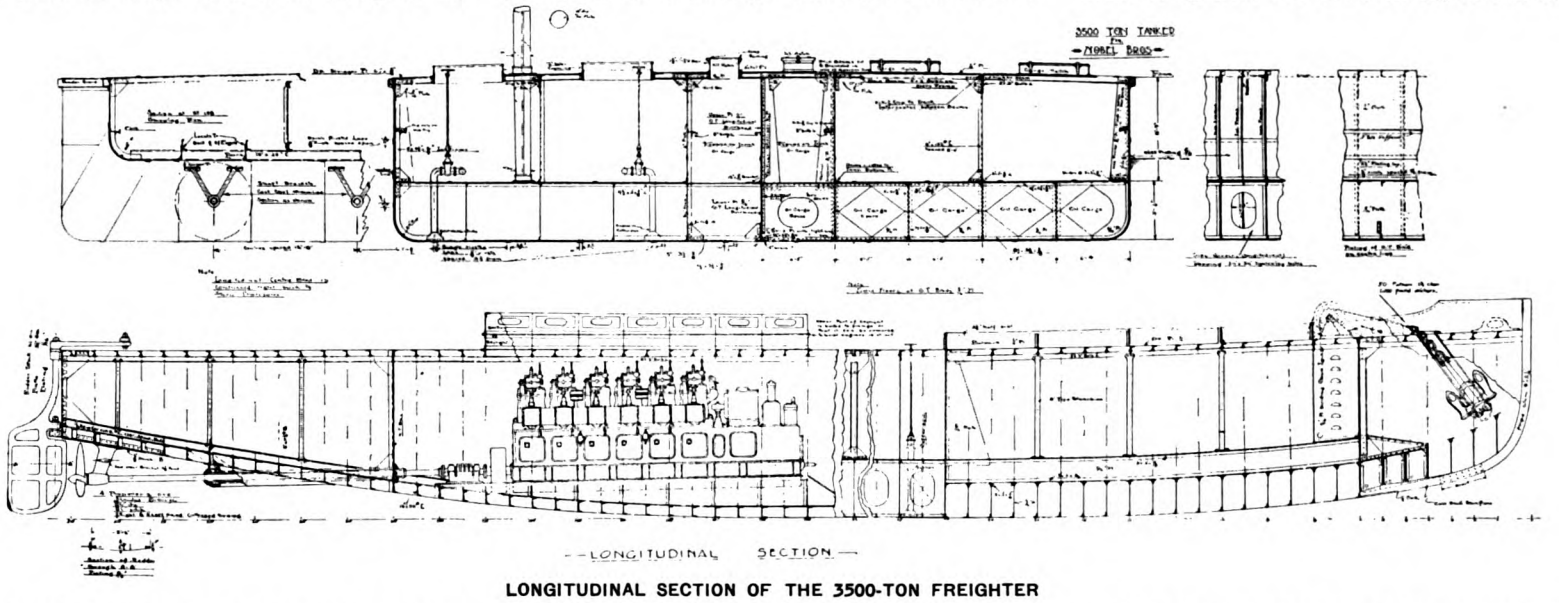
Their dimensions are as follows:

Length—325′ 0″
Loaded draft—5′ 0″
Cargo capacity—1,500 tons
Fuel capacity—20 tons
Horse-power—1,800
Speed (loaded)—12 m. p. h.

Each Nobel-Diesel crude oil-engine is of 450 h. p. and they drive propellers 4 ft. 10 ins. diameter by 4 ft. 10 ins. pitch.

To handle the cargo, a complete outfit of cargo winches and derricks are fitted, there being eight king-posts, four on each side, and sixteen derricks. Owing to the shoalness of the boats a very complete set of trusses are run throughout the hull, giving the necessary transverse strength against hogging and sagging strains. Very liberal accommodations are given for the crew in the two deck houses and in the forecastle. The pilot house is up near the bows on top of the forward deck house, the arrangement being similar to the practice on the Great Lakes tankers, the steering being electrically controlled from the pilot house. To handle the boat in the sharp turns of the river there are five rudders coupled up by a connecting rod and actuated by a hydro-electric steering system. These boats are interesting as being the highest-powered ever designed for shoal-draft work.

Judging by the small quantity of fuel-oil carried in these vessels we presume that there must be fuel-stations en route, as certainly they cannot have enough fuel-oil for a return journey in the tanks that are provided.



LONGITUDINAL SECTION OF THE 3500-TON FREIGHTER

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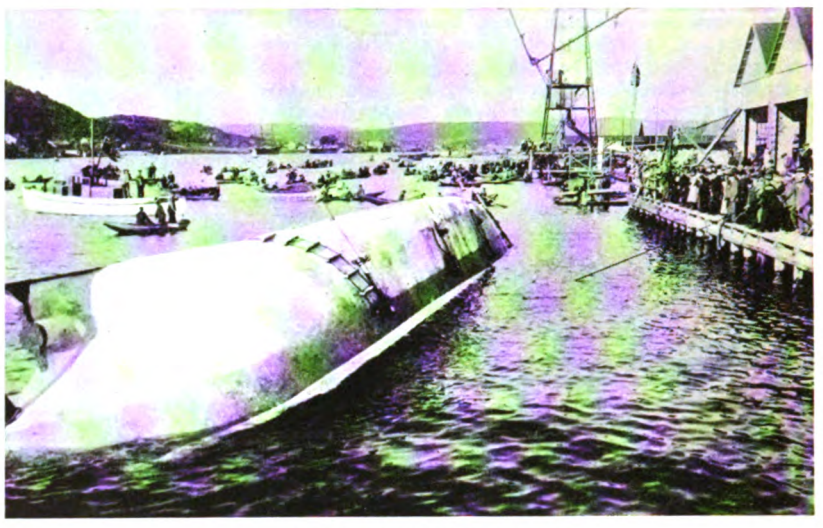
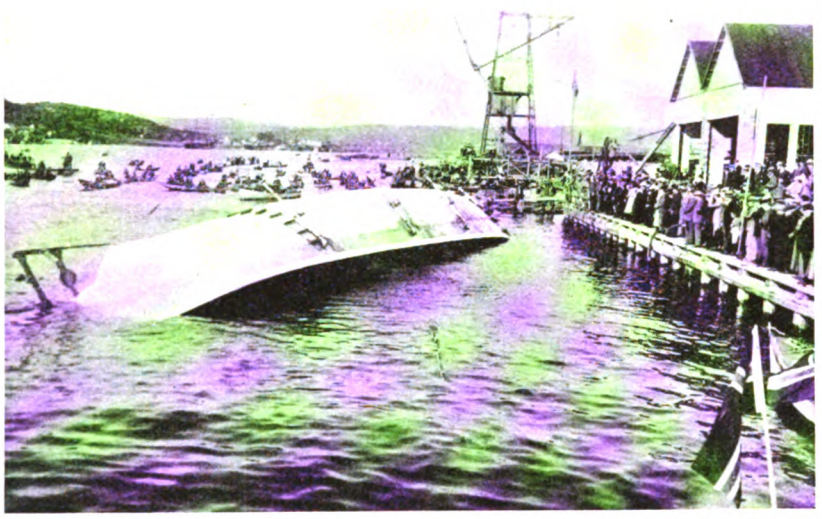
Launching of the Concrete Motor Barge "Beton I"

Novel Method in Use in Norway

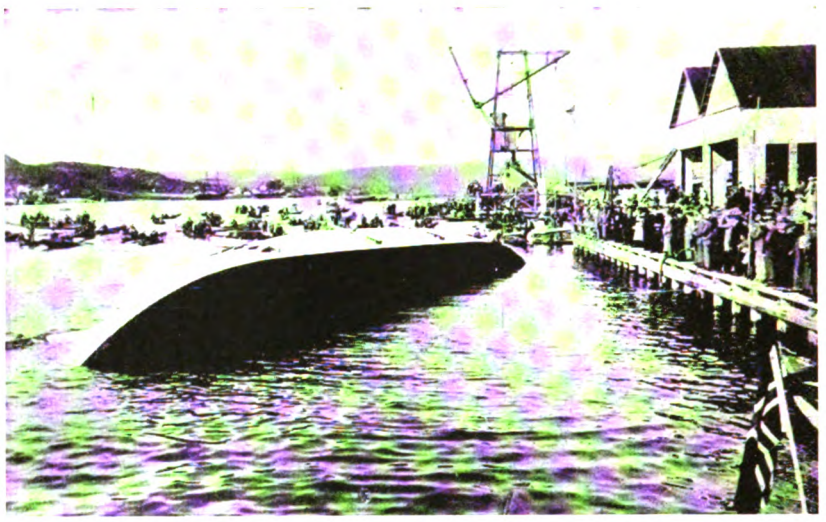
1. IMMEDIATELY AFTER THE LAUNCHING



2. BEGINNING TO RIGHT ITSELF



3. PORT SIDE CLEAR



4. HALF WAY OVER

5. RIGHTED

6. TOWING TO THE PIER

LAUNCHING OF THE CONCRETE BARGE WHICH IS TO BE EQUIPPED WITH A 70 H. P. SKANDIA MOTOR

The accompanying series of photographs are illustrative of the launching of the 200-ton concrete motor barge "Beton I" at the yards of the Porgrunds Cement Construction Company, of Porgrunds, Norway. As will be seen from the pictures, the launching was conducted after heretofore unknown methods. Being an experiment it was watched with great interest by many shipbuilders.

The boat was built on an entirely new system, bottom up, in which position the launching took place on underlying sledges, gliding out with the ship. When in the water the hull detaches from the sledge, gradually sinks to a certain point, then subsequently slowly rights on its keel.

This method, which is entirely new at this or at any other plant, was tried out after careful calculations by the cement works superintendent, Engineer Alfsen. The launching was in every way a success and was completed exactly as it was intended. Twenty minutes were required for the ship to right itself.

The vessel is to be equipped with a 70 horsepower Skandia oil-engine.

This ship of 200 tons was built in three weeks, but the next will require only about half that time. The original frame can be used for each subsequent ship of the same size. The casting of the ship when the frame was completed on this occasion took two days. It is intended to start a wholesale building of iron-concrete boats, 200 of from 500 to 10,000 tons. These last will be completed in six weeks.

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Notes on the Operation of Nlseco-Diesel Marine Engines

By Lieut. L. R. Ford, U. S. N., Chief-Engineer U. S. Motorship "Fulton."

[*Much of the successful running of motor vessels is due to the engineers, so we advise shipowners to place a copy of the following article in the hands of all their engineers—both motor and steam. So this particular article, while it will be found of great value, is published for the use of engineers of motorships rather than for the interest of shipowners. Lieut. Ford has had considerable experience with this particular make of engines and operators will find very many useful hints and tips for their guidance in his advice.*—EDITOR].

STARTING-AIR TANKS.—It is essential that the supply of starting-air be conserved, as failure to start at a critical moment may be caused by the careless loss of even 50 lbs. of air. In preparing to start, an observer should be stationed at the starting-air gauge when the starting air bottles are being cut in. As each separate bottle is cut in the slightest drop in pressure on the gauge will indicate that the pressure in this bottle is below that in the rest of the bank and it should be closed off immediately.

If the air pressure in starting banks is less than the compression pressure in the working cylinders the by-pass from the spray air line to the starting bank charging line should not be opened until the engine starts firing. It is possible to start the engine with 200 lbs. air-pressure, but this pressure is insufficient to spray the fuel-oil into the working cylinder against the compression. With the compressor suctions wide open and by-pass to starting-tank charging line closed a few turns of the engine will build up sufficient pressure in the spray air line to cause injection of fuel.

Control Group.—The New London Ship and Engine Co.'s design (two-cycle type engine) of operating gear for controlling the fuel-supply, starting-air, spray-air, reversing mechanism and compression release by means of a single hand wheel is very ingenious, but its successful operation depends largely upon the skill of the operator. A common mistake is to hold the engaging pin in contact with the air-control quadrant too long, if combustion does not start in the working-cylinders at once. This keeps the engine turning with air and quickly exhausts the starting banks. If the engine fails to get started on oil after a couple of trials no further attempts to start should be made until the cause of the trouble is located. Familiarity with the function of each part of the control group will enable one to run down the trouble by process of elimination. Sometimes the stop pin fails to retract after the cylinders have been vented through the relief valves and the starting hand wheel can not be turned to the starting position. This may be caused by a rusty pin, due to moisture in the air, or by a weak stop pin spring.

If the hand wheel is moved to the starting position and the engine fails to turn the trouble may be in the reverse gear. Failure of the reverse-gear to move may prevent the admission of starting-air at the proper time. Location of trouble in the reverse gear depends on the type of gear. In the case of the reverse-gear the trouble is usually due to locking pins sticking. This is invariably due to rust caused by moisture in the air. Frequent periodical inspections and cleaning of these pins should be the rule.

The most frequent cause of failure to obtain ignition in the working-cylinders is the presence of air in the fuel lines to the cylinders. Since the small quantity of oil required for each impulse stroke is forced into the end of a small pipe distant from the spray valve it is essential that the pipe throughout its length be filled with incompressible oil if any is to be forced out at the other end against the air pressure in the spray valve. The presence of air in the pipe results in compression and expansion in the pipe instead of ejection from the pipe.

Another cause of failure, not so common but sometimes experienced is the sticking of suction-valve stems of the fuel-injection pumps. If the lead packing around these stems is too tight the valves will be pushed open by the valve lifting fingers, but will not be returned to their seats by their springs and no oil will be forced through the delivery valves. A glance at these stems will show by their position whether or not they are in the closed position.

Air in the fuel lines is always due to leaky check-valves in the lines. The check-valves are perhaps the most important valves on the engine and they have a most difficult function to perform. They must admit the fuel-oil to the pressure chamber of the spray-valve and must seat easily and tightly to prevent air leaking back. Even the most minute leakage will cripple the engine. Each little increment of air coming through one of these valves increases the compressibility of the fluid in the fuel line and decreases the amount of fuel injected in to the cylinder at each stroke until finally that particular cylinder ceases to fire.

As additional air leaks in it finally works back to the pump chamber and gets into the other pumps and tne engine will stop. When this occurs no attempt should be made to start again until all the fuel lines have been cleared of air by pumping oil through until a solid stream of oil, containing no air bubbles, flows through each by-pass. If a check valve is known to be leaking and it is not desirable to stop the engine to repair it the by-pass on that particular fuel line should be opened and the leakage forced through the by-pass with the oil. This will prevent the air working back through the line and affecting the other pumps.

As originally fitted on one design of Nlseco engine these valves had ball-seats. These were changed to 45° angle seats in order to facilitate over haul. These angle seats have proven very satisfactory. In grinding in the check-valves only the finest grade of abrasive material should be used. The ground glass ordinarily used for low pressure work is entirely too coarse and will not make a tight joint. The grinding compounds that come in prepared form, in different grades of coarseness are good, if the finest grade is used.

Setting Fuel-Valves.—To distribute the work evenly to all cylinders it is essential that the measuring pumps deliver exactly the same amount of fuel to each cylinder. The amount of oil delivered is regulated by adjusting the opening of the measuring pump suction valves. Indicator cards give an accurate measure of the work of the cylinders but in the absence of indicators a simple way to measure the amount of oil supplied to each cylinder and thence the relative work is to cut out one cylinder at a time and allow the oil to discharge from the by-pass pipe into a can for a measured time. Taking the oil from each cylinder in turn in this manner, using the same time in each case, the discharge per minute from each pump may be determined by weighing. Differences in the amounts discharged can be corrected by adjusting the suction valve openings by means of the adjusting nuts on the stems.

Piston Head Gaskets.—The gaskets under the heads of working pistons sometimes blow out and allow the piston cooling water or oil to discharge into the working and scavenger cylinders. One indication of this is water or oil discharging through the scavenger receiver drains. In the case of engines with scavenger-cylinders separated from the working-cylinders the pet cocks in the exhaust-belts would offer a means of detecting the leak. When this occurs the faulty cylinder should be cut out and the piston cooling-water or oil cut down to the minimum required to carry away the heat of compression.

In making up these piston head joints it was formerly considered necessary to use a special kind of packing but experience has demonstrated that the regular contract sheet fiber packing answers very well if the joint is carefully made. Like every other pressure joint in the engineer's department it calls for more skill and care in making the joint and less dependence on the mysterious qualities of some particular brand of packing.

Valve Setting.—The setting of all valves should be checked frequently and after setting by the dial plate indicator cards should be taken to verify the correctness of the dial plate. The cranks should be centered and center marks made on fly-wheel or other convenient place. This gives a check on the dial plate and provides a means of resetting it if it should slip. A frequent cause of incorrect timing of spray-valve is the wear of cam rollers. Reduction in diameter of cam-roller will cause delayed opening of spray-valve.

Sometimes a cam-roller will stick on its pin and the cam will quickly wear a flat spot on the roller. Irregularities in the combustion line on the indicator card may sometimes be traced to a flat spot on cam roller. If the roller has been freed on its pin it revolves while in contact with the cam and continues to spin after contact with cam has ceased. The cam will make contact sometimes on the high part of roller and sometimes of the flat spot and injection of fuel will not occur at the same point each time.

Scavenger-valve springs sometimes break and may be detected by the failure of valve to snap back to its seat quickly. An indicator card with a stepped expansion line often indicates leaky scavenger valves, though the same effect is produced by leaky piston rings or lost motion in the indicator gear. On one particular engine of this make a simple device is in use for testing the tightness of scavenger valves and relief valves. The valve and its body are removed from the cylinder head and bolted to a casting which is bored out under the valve seat and tapped for a small pipe connection. Air of any desired pressure is admitted to this recess under the valve and the valve set for lifting or its tightness verified.

Occasionally while underway a gradual slowing down of the engine may be noticed and the first thought of the uninitiated is of hot bearings. A glance at the exhaust may show black smoke issuing. This is an indication of insufficient spray air, due to clogged strainers in the spray air line. If a by-pass is opened in the line the engine will come back to normal speed and the exhaust clear up.

Lubrication of air compressors should be closely watched. If too much oil is admitted to the compressor it will later show up in the spray air line and spray valves in the form of jelly.

An exhaust that appears colorless to the eye

THE UNITED STATES SUBMARINE-DEPOT MOTORSHIP "FULTON." LIEUT. FORD, THE AUTHOR OF THIS ARTICLE, IS THE CHIEF ENGINEER OF THIS SHIP. THE "FULTON" IS DRIVEN BY A NLSECO-DIESEL ENGINE

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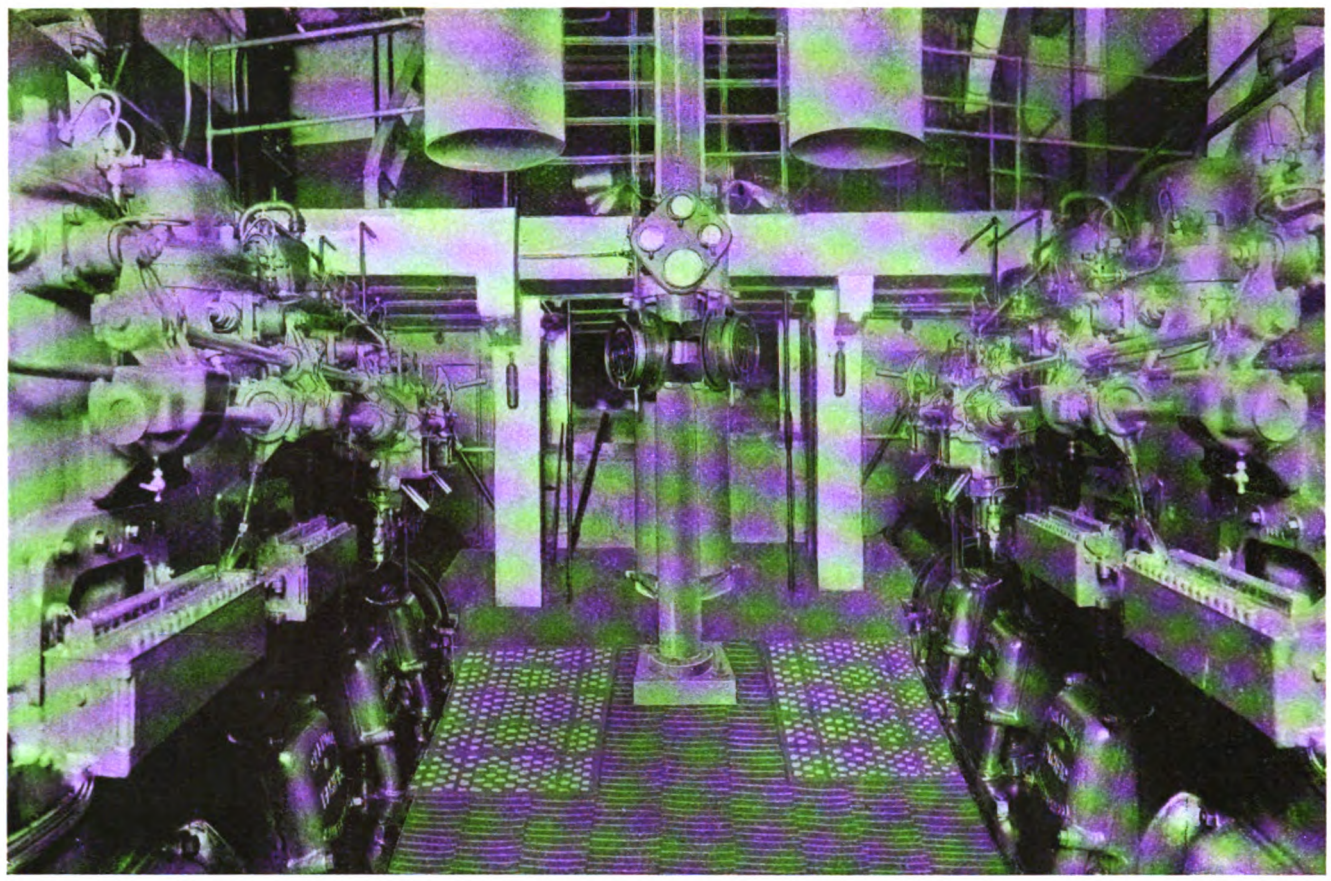
The Motor Auxiliary "Barleux"



ENGINE ROOM OF THE MOTOR AUXILIARY "BARLEUX," SHOWING THE SPLENDID INSTALLATION OF THE TWIN 240 H. P. SKANDIA ENGINES MADE IN THIS VESSEL

ONE of the finest oil engine installations yet made on the Pacific Coast was that of the motor auxiliary "Barleux," which recently finished loading a cargo of 2,000 tons of flour for the French Government at Seattle. The installation, which we show, was completed in record time and little room could be left for improvement. The engineer in charge of the installation was A. Chew of the Washington Shipping Corporation, the builders.

The "Barleux" is 250 feet over all, 220 feet on the keel, 44 feet wide, 21 feet moulded depth, and has a d. w. c. for 2,600 tons. She is owned by the French Government and is operated by Thorndyke and Trenholme of Seattle. Her equipment consists of two 240 b. h. p. Skandia engines and one 35 h. p. Skandia engine which drives the generator which runs the auxiliaries. On her trial trip under the direction of Capt. C. W. Call the "Barleux" logged better than 7 knots and upon her return from the trials was immediately accepted by the representatives of the owners. The remainder of her equipment consists of a steam boiler with 550 sq. ft. of heating space, which gives steam for the deck winches and the anchor hoists made by the Heffernan Engine Works of Seattle. It also supplies steam for the auxiliary fire pumps located in the engine room.

The "Barleux" is tanked for 1,000 bbls. of fuel oil and 8,000 bbls. of water, giving it a cruising radius of 4,000 miles.

She was completed at the yards of the Washington Shipping Corporation in September and is rigged as a four-masted bald-headed schooner with three head sails. Built after the plans of Jos. A. Sloan, she is of very strong construction, having steel reinforced hatches and cast steel knees.

The "Douamont," built by the same company, is a sister ship to the "Barleux" in all respects. She will have her trials about Dec. 1. Another sister ship, Hull No. 7, will be launched about Dec. 15; she will also have the same equipment as the "Barleux." The construction on two more ships 18 feet longer and two feet deeper than the "Barleux" being built by the same company for French interests and equipped with twin 350 h. p. Skandias, is well along at the same yards.

Other orders placed in this territory with the Skandia Company are those of the Martinolitch Shipbuilding Company for six 240 h. p. engines for three 2,500-ton ships which will also be equipped with Skandia auxiliaries; the Sandstrom Shipbuilding Company, six 500 h. p. for three 3,000-ton motorships, and the National Shipbuilding Company for four 350 h. p. for two ships for Norwegian interests.

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is not always an indication of perfect combustion. A pet cock in the exhaust belt of the cylinders or in the exhaust-pipe may be open and show no sign of smoke; but, if a sheet of white paper be held in front of the cock it may collect fine drops of oil that have gone through the cylinder unburned. Sometimes it is possible to correct this to a slight degree by increasing the spray-air pressure, but more often it is due to the design of the spray-valve, which may fail to sufficiently atomize the fuel-oil.

After any adjustment of bearings or any work involving removal of pistons, cylinders or heads compression cards should be taken with the indicator. A change of a few thousandths of an inch will affect the compression. This precaution is especially necessary when a piston-head gasket has been renewed.

For making joints under cylinder-heads, in exhaust-lines, etc., a medium weight drawing-paper is very good and can be obtained in rolls. Old charts are good if the gasket to be made is small enough to come between creases where the charts have been folded. A crease in the chart makes a weak spot in the gasket.

The standard cone joint used by the E. B. Co. for high-pressure copper pipes is excellent practice and very simple, but a joint that is opened up frequently is liable to become leaky. When this occurs the end of the pipe should be annealed, the bell hammered out, a new bell formed and the pipe again annealed.

DOW BUILDING DIESEL ENGINES.

The first pair of Diesel engines built on the Pacific Coast is under construction at the plant of the Dow Diesel Engine Co., of Alameda, Cal., for Libby, McNeill & Libby, and will be installed at Portland in a motorship now being built by Standifer & Clarkson of that city. The Dow people are acting under direct commission of the patentee of the engine and have the use of plans and specifications drawn by the makers of these engines in England.

This company is planning to make a considerable improvement at its plant. Both the brass and iron foundry is to be enlarged and when completed the foundry will be one of the largest on the coast. It is planned to increase the brass foundry capacity from 5 to 8 tons a day and the iron foundry from 10 to 16 tons a day. An additional cupola will be built on the iron foundry.

THE GRACE MOTORSHIP FLEET.

W. R. Grace & Co. have become converts to the advantages of the motorship over the steam vessel for freight purposes and are not convinced that it may not be better for passenger service. The firm now has a fleet of four large ships, although only one is actually completed and in operation. These vessels will be used exclusively in the South American trade, two on the Pacific and two on the Atlantic. All were built by Mathews and Andrew Peterson at Grays Harbor. The vessels are sister ships of the same dimensions and tonnage, so that a description of one fits all four. Length between perpendiculars, 225 feet; over all, 240 feet; beam, 43 feet; draft, 19 feet; depth of hold, 25 feet; tonnage, 2,100. Each vessel is equipped with two 320 Bolinder engines. There has been a slight modification by adding a bearing fold to the flywheel. This is expected to overcome all tendency to breaking which the compressor shaft might develop. A steam condensor plant is used to operate the winches and one k. w. wireless outfit is installed having a radius of 2,000 miles. A ton and a half Brunswick ice-making machine is installed below the galley. Accommodations for about thirty passengers have been provided for; this is somewhat in the nature of an experiment. While the vessels are straight motorships they are built on steamship lines with all the conveniences that have been developed for such vessels, and some not usually found on freight steamers. The quarters of the crew in the forecastle are especially airy and a shower bath for the use of the crew is not found on all vessels.

A SENSIBLE RULE.

Under the new Norwegian shipping regulations every sea-going ship must carry at least one motor lifeboat, together with fuel for two days' cruising.

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MOTORSHIP "SIERRA."

Much interest has been evinced in the voyage of the M. S. "Sierra," which arrived in San Pedro on November 3rd after a trip of twenty-three days from Caleta Buena, Chile, at an average of two hundred miles a day. An important feature of this vessel's voyage and one that will appeal to all ship owners in this day of high fuel cost is the fact that the "Sierra" was enabled to make a whole round voyage from San Francisco to the different ports on the South American Coast and return without having to purchase fuel oil and at the same time, owing to the small amount of space necessary for the engines and the elimination of the boilers, more space was available for the cargo than would have been possible in an ordinary steam schooner of the same dimensions. The steam ships that have lately been engaged in traffic to these South American ports have had to purchase fuel oil at an extremely high price and as they are only fitted with a fuel capacity for about ten or twelve days steaming radius, the cost in this direction has been enormous. It is also to be noted that vessels equipped with steam engines have to purchase water for replenishing waste in boilers in these ports, which owing to its scarcity in South America, is sold at an exorbitant rate, while in the case of the "Sierra" and like vessels no water is purchased.

"SANTINO" NOT TORPEDOED.

It has been mentioned in several marine journals that the M. A. "Santino" operated by Gaston, Williams & Wigmore of New York, had been torpedoed and sunk by a German torpedo while on her way from Boston to Italy. There is absolutely no truth in this for at the time of writing the "Santino" is lying at the dock in Norfolk, Va., loaded with a cargo of coal for France, and awaiting clearance from the Government.

The "Santino" is the first of a fleet of such ships built by the Grays Harbor Shipbuilding company for the Globe Line, a subsidiary line of the Gaston, Williams & Wigmore company. She is equipped with the first set of Sumner Oil engines made. A complete description of this vessel was printed in the April issue of Motorship.

EXCELLENT DIESEL ENGINE BUSINESS.

The McIntosh & Seymour Corporation of Auburn, N. Y., have under construction 22 marine Diesel engines aggregating 11,000 b. h. p., which indicates the vast amount of business to be obtained, even by a company new to the marine oil-engine business; for, this concern, although builders of marine steam engines for many years, and also stationary Diesel engine builders, have only recently taken up the construction of marine-type Diesel engines.

All these engines are of 500 b. h. p. each, and are of the trunk-piston type without crossheads and guides, but directly reversible. They have six cylinders, 16" bore by 22" stroke. Eight are for the Alaska-Pacific Navigation Co., four for the Aluminum Co., of America, and two for the Texas Co. In about a year they may undertake the building of high-powered sets.

MOTORSHIPS FOR SOUTH SEAS.

Four new motorships for the South Sea trade are being built and three old vessels have been converted into motorships for the same trade at the Frank Stone Shipbuilding yards in Alameda Creek, East Oakland. The "Palawan," one of the new ships, and the "Seafarer," "Marian" and "Ida Etta," the old vessels which were motor-powered, belong to Atkins, Kroll & Co., of San Francisco. The three other new motorships, the "Motau," the "Mauno" and the "Murua," belong to the Burns-Philp Co., of Sidney, Australia. The "Palawan" is 176 feet over all, 38 feet beam and 14 feet 6 inches moulded depth, with a gross tonnage of 500 tons. It is equipped with two 110 h. p. Union gas engines. The three vessels constructed for the Burns-Philp people are sister ships. Each measures 117 feet over all, has 27 feet beam and 11 feet 3 inches moulded depth, with a registered tonnage of 275. Each one of these vessels is equipped with one 110 h. p. Union gas engine. Of the newly powered vessels the "Seafarer" was formerly a yacht, 85 feet in length, 18 feet beam and 10 feet in depth. The "Marian" was also a yacht, 75 feet in length, 16 feet in beam and 10 feet in depth, and the "Ida Etta" was formerly a sealer in the Behring sea. It is 95 feet in length, 18 feet in beam and 10 feet in depth. All these reconstructed vessels have been equipped with one 35 h. p. Union gas engine each.

EVERY FISH caught on the Pacific Coast for Commercial Purposes is by means of or handled by a motor-propelled vessel.

Pacific Fisherman

is a journal of fifteen years' standing, devoted exclusively to the Commercial Fisheries of the Pacific Coast. Every Salmon Canner and Packer of Fish Products on the Pacific Coast is on its subscription list.

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L. C. SMITH BUILDING, SEATTLE

SALMON TUG WITH 200 B. H. P. MARINE GAS ENGINE

HERZOG SUPPLIES STEERING GEAR FOR PORTLAND SHIP.

The Herzog Electric & Engineering Co., of San Francisco, has closed a contract to supply all the electric steering gear for a 300-foot motorship which is now being built by the Standard Construction Co., of Portland, for S. T. Williams. The Herzog system of electric steering gear has proved very successful in a number of vessels which has been supplied by this firm. It is especially economical in the use of power, so the users say.

TOWBOAT COMPANIES TURN TO MOTOR POWER.

While the motor towboat is no new thing, every month sees a further turning away from the old steam to the motor-driven tug or tow boat. Although few steam tugs are being placed in commission about San Francisco Bay, every month sees the increase in the number of motor-driven vessels of this kind. At the present time the Crowley Launch and Towboat Co., of San Francisco, is having six boats built by John Twigg & Sons, and only a short time ago it received six from the William Crier yards, which were shipped to Central America for use in those waters. All twelve of these boats were equipped with Standard gas engines. The Henry Peterson Launch Co., Inc., is having three boats built ranging 43, 54 and 64 feet in length respectively. These are equipped with Union engines developing 50 h. p. in the first, 80 h. p. in the second and 110 h. p. in the third boat.

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THE MARINE OIL-ENGINE IN ENGLAND.

The surface-ignition type of marine oil-engine is making excellent progress in England, and the Torbinia Engineering Co. of Lowestoft (Eng.) and New York (U. S. A.) report receiving an order for twelve marine crude oil-engines of 60 b. h. p. and twelve of 30 b. h. p.

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The Widdop Marine Oil Engine

MOTORSHIP is enabled to reproduce some very clear cut photographs of the oil engines built by the H. W. Widdop Company of Keighly, England. This company has been putting on the market oil engines of different types for different purposes for over twenty years and is one of the companies which have helped to keep up the high standard which British manufacturers have at all times maintained. From the accompanying illustrations the design and general arrangement of their engines may be obtained. The photograph of the three-cylinder model suffices for the 50, 80, and 100 h. p. sizes.

One of the most attractive features is the patent governing arrangement. The governor which is entirely enclosed is driven by case-hardened gears from the crank-shaft and is so arranged that two, three, or four fuel pumps can be mounted on the outer casing. The fuel injection varies according to the load; the governor taking full control from full to no load. By an arrangement such as this it is claimed the engine can run for long periods light and will immediately take up full load without the slightest hesitation. The speed of the engine can also be varied down to about one-third and still the governor has full control from full to no load. This feature will be appreciated as it is a distinct advantage and advance in this type of engine.

Another outstanding feature is the lubricator. This device possesses all the advantages of a force feed lubricator, but it has an extremely small number of working parts. In this lubricator failure of any one feed can be detected immediately and when this is done, as there is only one ball valve to each feed on the outside next the union, it can easily be removed and cleaned without interfering in any way with the other feeds.

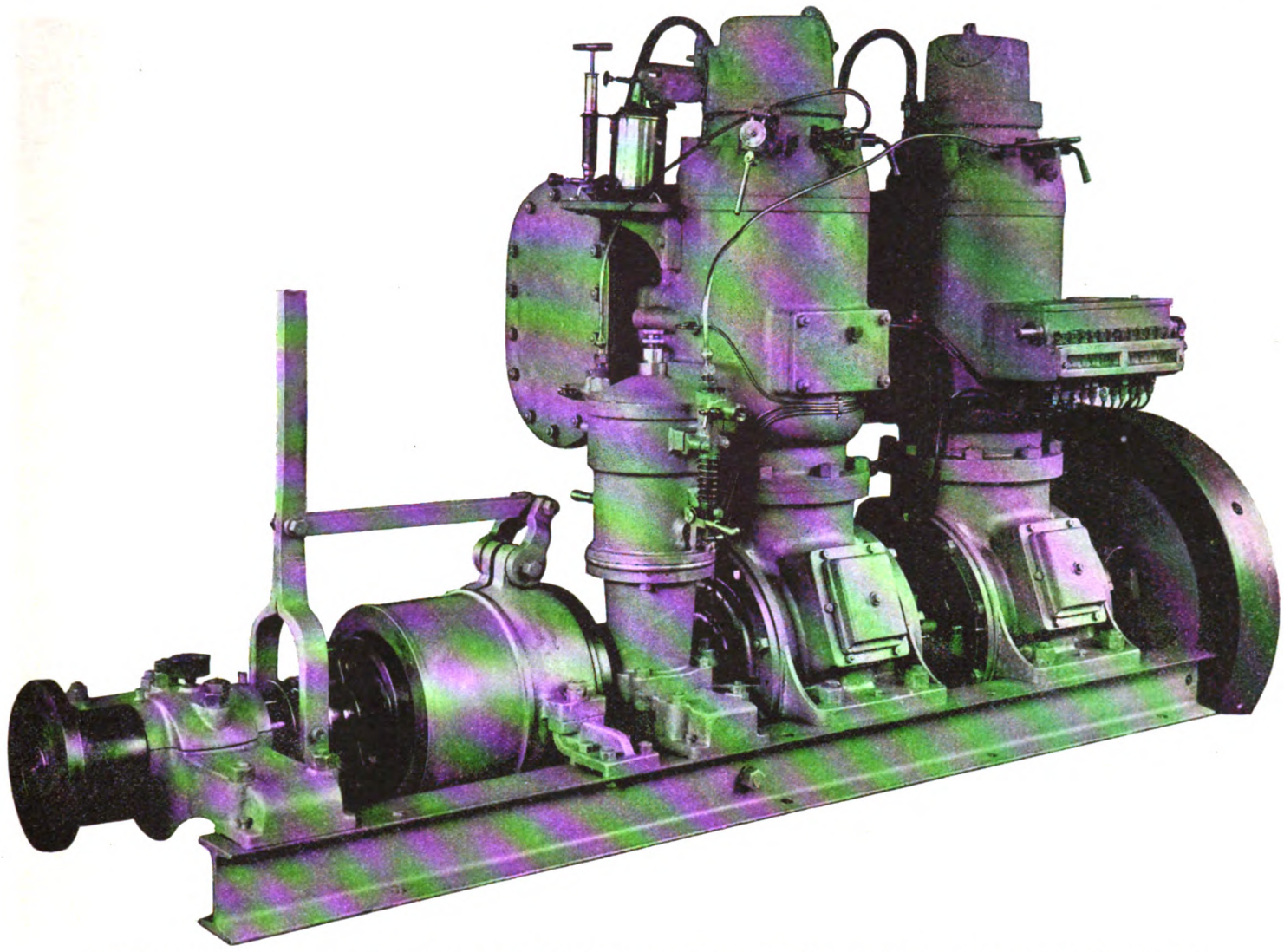
The reverse gear is very strong, having neutral, ahead and astern drives. The neutral and reverse is effected through bevel gears when the friction discs are released from the head drive.

The thrust in both directions is taken by ball bearings, the engine being relieved in any direction. The bronze circulating pump passes water through copper pipes to the cylinder and water-cooled muffler.

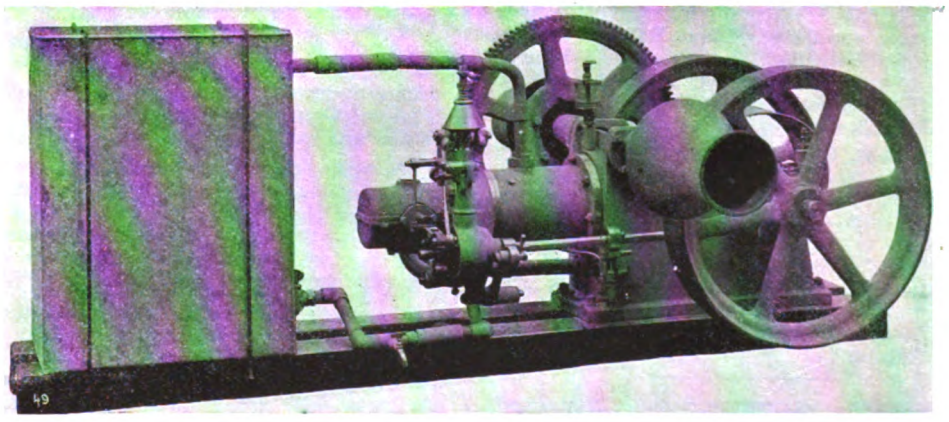
The single cylinder engine which we show is suitable for auxiliary work such as driving dynamos, etc., and is fitted with a specially sensitive governor for steady running under all conditions of load and represents the 25, 40, and 50 h. p. sizes.

Their deck winch should be of interest to owners of small vessels; the engines of their horizontal oil engines being the same as those of the deck winches. The bearings for carrying the shaft are fixed to the main engine casting.

The shaft is driven by double Helical gears which are practically silent in the running. The warping drums are keyed on the second motion shaft so that in addition to the crank shaft only one extra shaft is required, making the whole a compact arrangement with hardly a chance of getting out of alignment. In cases where the warping drums are required to project beyond a galley or other deck construction, an outside A-bracket is supplied to be bolted down to the deck which takes the stress on an extended shaft. The engine works on the four-cycle principle; the vaporizer being at the end of the cylinder. All the valves are mechanically operated. The governing is of the "hit and miss" type and on the cut-out stroke only pure air is admitted to the cylinder. The fuel supply is carried in a container at the side of the engine the fuel being pumped up into a small chamber on the side of the vaporizer and mixes with the auxiliary air before entering the cylinder, and passing around the heated walls of the vaporizer enters the cylinder as a perfect gas. This method insures a perfectly clear exhaust and consequent economy in fuel. In connection with the vaporizer is an automatic ignition device which the engine will run lampless once it is started. It is extremely



WIDDOP MARINE OIL ENGINE, BUILT BY H. W. WIDDOP COMPANY, KEIGHLY, ENGLAND, ILLUSTRATIVE OF THE 50, 80, AND 100 H. P. SIZES



HORIZONTAL OIL ENGINE-POWERED DECK WINCH, BUILT BY THE WIDDOP COMPANY

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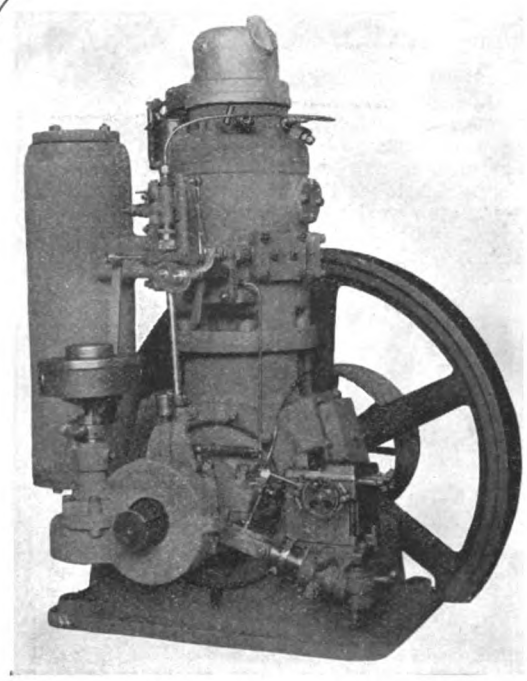

WIDDOP AUXILIARY ENGINES—BUILT IN 24, 40 AND 50 H. P. SIZES

simple in construction; none of the valves have packed joints which will be appreciated by seafaring men. The cooling tank need not be fixed as shown, but may be placed in any convenient position. In some cases it is simply connected up by short lengths of rubber tubing and is disconnected and stowed away during the voyage. The total weight for the complete winch is about ten cwts. or about fifteen cwts. packed for shipment.

OPERATIONS OF ATLAS-IMPERIAL COMPANY

The Atlas-Imperial Engine Company of Oakland, Cal., are shipping to the Bolivia Tin Corporation of Bolivia, South America, four 150 b. h. p. four-cylinder Diesel engines. These engines are thoroughly equipped for long continuous runs and are massive in construction. They are to furnish the power for two dredges working at an altitude of 11,000 feet. The engines had to be made special on account of this altitude, which diminishes the power of a given cylinder dimension by 30%. Complete equipment, air flasks, auxiliary compressors and auxiliary engines for the compressors, etc., are being furnished. Two 110 b. h. p. four-cylinder Diesel engines have been shipped to the Otter Dredging Company of Iditarod, Alaska.

This company has recently supplied the Apex Fish Company of Anacortes, Wn., with a 110 b. h. p. engine which has been installed in their tender "Ajax." They are also building for the same company a 6-cylinder 350 b. h. p. engine to be installed aboard their freighter "Apex." The Robertson Godson Company of Vancouver, B. C., have received from the Atlas Company their 350 b. h. p. engine, which is being installed in the "Bowler."

"MOUNT RAINIER" READY FOR TRIALS.

The motor auxiliary "Mount Rainier," a sister ship to the "Santino" is having her twin 350 b. h. p. Sumner Oil Engines installed at Seattle, Wash. The installation will be completed by the time Motorship goes to press.

The "Mount Rainier" is the third ship built by this company for the owners, Gaston, Williams & Wigmore, of New York, all of which are powered with Sumner Oil Engines. She is one of the largest wooden vessels built on the Pacific Coast being 290 feet long and 48 feet wide, having a capacity for 2,200,000 feet of lumber.

Mr. Alexander Hynd, representing the owners is now in Seattle awaiting the trial trip of the "Mount Rainier."

SANDSTROM SHIPBUILDING COMPANY OPERATIONS.

The Sandstrom Shipbuilding company of Meadow Point, Wash., have now under construction three vessels, one in full frame and two others framing. They have orders for seven vessels, five of which are to be auxiliary powered and the remainder to be full powered Diesel engined ships. Skandia engines are to be installed aboard the auxiliary powered ships.

An Important Motorship Enterprise

Orders for Twenty-Four Vessels Placed by One Company.—Engines to Be Built by American Skandia Concern.

IT is of little use blinding our eyes to the fact that the enterprise and foresight of European shipowners are responsible for a very considerable portion of the orders for motorships and auxiliary motorvessels that have been placed in the United States during the past few years, and in many cases it was not until these motorships were building or completed that some domestic shipowners fully realized that here were ships worth buying, and then purchased the same at prices that amply repaid the Norwegians for their courage.

Just at the present time most American shipowners are "marking time" with one eye on Washington and the other on their bank balances. They say that they cannot place orders for motorships, because the Government will not let them do so, or because the freight-rates fixed by the Shipping Board will not enable them to operate their ships at a profit owing to the high constructional costs of hulls and oil-engines. May be the secret of this inactivity in more than one case rests in that little word "profit," for, after the enormous profits to which shipowners lately have become accustomed, moderate profits may not form sufficient inducement for them to invest their capital in ships, regardless of the fact that the very history of the world rests with ships, ships and ships; so some of them apparently prefer to invest their surplus funds in gilt-edge securities, mortgages, etc. American shipowners today should be ordering every hull and engine that many smaller yards yet can take, and if the Government does acquire them later they will be reimbursed to at least the extent of their outlay.

It is not with pleasure, but with reluctance that we have written the foregoing remarks; but, further European enterprise has just come to our knowledge which clearly shows that if the Norwegians can get busy building motorships, then Americans can and must, for, where there's a will there is a way.

During the last few years there has become very prominent in the shipping circles of this country a man named Christopher Hannevig, and he has built ships right on our own soil at times when domestic shipping men thought the future dark, and later sold them to these same shipowners. This has earned him millions of dollars and today he is a very wealthy man with several important shipyards under his control, also a bank. Mr. Christopher Hannevig, who has been ably assisted by his brother, Mr. Finn Hannevig, was responsible for the building of what still are the four largest steel motorships in this country, and all now are American owned.

His latest enterprising venture is the erecting of a new wooden motorship yard at Harbor Grace, Newfoundland, where orders already have been placed for twenty-four 240 b. h. p. auxiliary schooners of about 700 tons d. w. c.

For these ships an order has been placed with the Skandia-Pacific Oil Engine Company of San Francisco, Cal., for 48 surface-ignition type crude-oil marine engines, each of 120 b. h. p., and of the two-cycle, direct-reversible class. His latest order even is greater in importance than the order placed by Mr. Hannevig with the Bolinder Co. of Stockholm, Sweden, for the oil-engines of the four tankers built at Baltimore, Md., which consisted of 9 engines each of 500 b. h. p., as it means a total of 5,760 b. h. p. Unfortunately, we have yet to see a domestic shipowner place such an important motorship order, and the engines alone represent over half-a-million in cash. There is, however, some satisfaction in the feeling that this order will benefit considerably the American marine oil-engine business.

About a dozen of these twin-screw auxiliary schooners will be ready about the end of one year. Some will be engaged in general trading, others will be sold if purchasers are found, while the remainder will form a fleet for a new service carrying fish between Newfoundland and New York, thus providing a regular fresh fish supply for that great city. We understand, unless otherwise sold, these vessels will be operated under British registry, the operating company being formed in Newfoundland for that purpose.

This calls to mind that another big company has been formed in Newfoundland for operating a motorship fish-carrying fleet between that island and England. These vessels will be full-powered and each will have two 350 b. h. p. Swedish built Polar-Diesel engines installed. Details of this venture are given elsewhere in this issue.

The Submarine Sinkings

How useful it would be if the Allies knew exactly how many submarines Germany manages to maintain regularly at sea. There probably is a very large number. But, if one took as an estimating basis the reports daily published in newspapers then Germany must have many hundreds of these craft; because, one reads that every ship entering American ports has a fight with, or is chased by at least two U-boats. Most of them say "we certainly sunk one, and we believe two!" We ourselves have a friend aboard an American liner, who every voyage comes to see us. Each time he solemnly and seriously relates how many submarines they sink on that particular voyage. Sailors, of course, are noted for their "tall yarns," which after a while are believed by themselves. The old sea-serpent of the wind-jammer days is dead, and it was a U-boat that killed it. Submarine stories are more modern and exciting. When a ship arrives in port undamaged it generally is a safe bet that no submarine was sighted on that trip over.

However, there can be no doubt but that the submarines are right on the job, and any freighter or tanker that happens to pass within ten or fifteen miles of a Hun sub-seas boat knows it fairly forcibly, for the German commanders are acquiring expertness with practice.

The war zone covers a good many thousands of square miles of sea-area, over which there are hundreds and hundreds of allied patrol craft. Also freighters do not follow a set course and enable the submarine to lie in wait, but take different routes, which must keep the German craft constantly on the move, aside from the necessity of dodging T. B. destroyers, etc.

Yet, in the six months (approx.) from March 4th to Aug. 22nd no fewer than 1,426 French, British and Italian ships were officially attacked, apart from several hundred Norwegian, Dutch, American, Swedish, etc., vessels. Of these 858 were sunk and 568 escaped. Many neutral boats were stopped and allowed to proceed after examination by the submarines. (From Feb. to Oct. 5 no fewer than 791 ships were sunk).

In all at least 1,600 ships were stopped, sunk, or attacked during the aforementioned period of less than six months! This gives an average of about **nine ships every day intercepted by U-boats.**

Now, those who were accustomed to crossing the Atlantic before the war, when ships were taking almost set lanes, know that it was a rare thing to sight more than half-a-dozen other ships, yet the view from the deck of a modern liner on a fine day is at least 20 miles in all directions of the compass, giving a view over hundreds of square miles of sea. Exactly how many square miles we will leave our mathematical friends and slide-rule experts to figure out.

But, one thing our reasoning clearly indicates is that there must be a very large number of submarines in service, or else those at work must do some real hustling. Above all it indicates that the Diesel engines of these submarines must be remarkably efficient and reliable. Consequently, those shipowners who will not believe in the reliability of the Diesel engine for ship propulsion will have tangible proof every time one of their ships is sunk.

NEW 6,500-TON TWIN-SCREW MOTORSHIP.

There now is being laid down on the stocks at J. & K. Smit's shipbuilding yard, Kinderdyk, Holland, a steel motorship of 6,500 tons cargo-capacity. This vessel will be equipped with two four-cycle type Werkspoor-Diesel crude-oil enengines aggregating 2,800 i. h. p. The same stocks have just been vacated by the S. S. "Ganymedes," which recently was launched for the Royal Dutch Steamship Co., of Amsterdam. She is a vessel of 4,400 tons deadweight carrying capacity, driven by Werkspoor steam engines 23 inches, 37 inches, and 61 inches by 45 inches stroke.

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MOTORSHIP

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MOTORS IN ALL SAILING SHIPS.

An Important Recommendation Emanating From England.

SOME months ago "Motorship" advised the installation (by Federal orders if necessary) of all suitable sailing-ships with motor-power, and we are glad to see journals of other nations also recommending the same proposal. We draw the attention of the U. S. Shipping Board Emergency Fleet Corporation and of domestic shipowners to the following, which is extracted from an article in our esteemed contemporary "Shipping World" of London for October 3rd, 1917:

"At the present moment there are something like 6,000 sailing vessels engaged in trading—in both long and short distance voyages" . . . "If fitted with oil-engines these ships would be of infinitely more value to the Allies."

"A more or less regular speed in the auxiliary sailer can be maintained throughout the entire voyage. Higher freights are obtainable. Precedence, moreover, is usually given to auxiliary vessels over ordinary sailing vessels when docking, entering, or leaving port, and the ships are given steamer turns. There is, of course, an entire absence of towage expenses. The donkey-boiler is done away with, and self-contained motor winches installed" . . . "It is customary to use the engine only when a vessel is becalmed, or to assist her during bad weather, but it will be readily appreciated that in a sailing vessel, with sails set and engine under way, the speed with a fair wind should be equal to, if not greater than, that of the ordinary steam tramp."

"While the initial outlay is under consideration the savings during the life of the vessel should also be borne in mind. In the majority of instances it has been found in actual practice that with a medium-size sailing vessel the engine pays for itself in a very few voyages, and with the larger vessels—those of 3,000 to 5,000 tons d. w. —frequently the expenses saved in towage and reduced insurance, taken in conjunction with the increased freights and earning-capacity, will pay for the engine in two round voyages to South America from the United Kingdom." . . .

"A question over often raised is whether single or twin screws are preferable for auxiliary work. Putting aside the predilections of particular owners, it is safe to state that for a conversion job, twin screws are preferable, especially if the intial cost of structural alterations is to be considered. For a new vessel building as an auxiliary, the single crew is to be preferred, as it should be remembered that a certain amount of efficiency is lost with the twin-screw jobs. In other words, a 240 b. h. p. single-screw installation will give a greater speed in a given vessel than two sets each of 120 b. h. p." . . .

"The desirability of the Government encouraging this auxiliary program of marine engineering has occurred to many minds, and it should not be a difficult matter for a certain sum to be set aside and devoted to help financially those sailing ship owners who are willing to fit engines into their craft." . . . "It is hardly to be expected that a commercial firm should continually finance these schemes without some encouragement from the Government. We are told that the war is costing Breat Britain something between seven and eight millions per day. It may be readily imagined how large a number of first-class auxiliary installations could be carried out for a sum of money not exceeding about six hours of warfare, and in return the mercantile marine of the United Kingdom would be practically doubling its sailing-vessel tonnage, for an auxiliary-vessel makes at least twice the number of voyages, and therefore carries twice the cargo as compared with craft depending on sails for propulsion."

"In the opinion of many well able to judge it is considered that the time has now arrived when owners of sailing vessels should combine together, and arrange for a deputation to wait upon the Controller of Auxiliary Shipbuilding with the object of obtaining his assistance and furthering this auxiliary scheme."

RE "DIESEL ENGINE REVOLUTION-SPEED AND EFFICIENCY."

In this issue we draw special attention to the article on page 9 entitled "Diesel Engine Revolution-Speed and Efficiency," which is one of the best of the numerous articles contributed to Motorship by Thos. Orchard Lisle. Our readers doubtless will have noticed that Mr. Lisle has an unusual way of bringing out into the limelight features on the operation of motorships that are apt to be overlooked by the average shipowner and naval architect, and this he has particularly done in the discussion in question. In this instance he has raised an entirely new issue and one that is worthy of proper discussion.

HAS THE WAR HINDERED THE DEVELOPMENT OF THE MARINE OIL ENGINE IN GREAT BRITAIN?

NONE of the British shipowners or shipbuilders will breathe a word as to what they have been doing regarding the production and development of the marine oil-engine since the commencement of the great war; but, we draw attention to the following statement taken from an editorial leader in the English "Motorship and Motorboat" of Oct. 25th, 1917.

"With regard to oil-engines, by which the ships of the future will be propelled, we believe that such developments have taken place during the war as will give us the lead in this line after peace is brought about. Before the war this country certainly did not occupy the first position for the production of large marine oil-engines, but British engineers and engine makers were then rapidly making up the leeway lost by entering the field later than their foreign rivals, and **this process has been vastly speeded up during the last three years.**"

This statement would indicate that the Controller of British Shipping is fully alive as to the importance of the oil-engined motorship, apparently strangely contrasting with our own Shipping Board Emergency Fleet Corporation who, if actions made may be taken as a guide, seem to believe that the construction of motorships in America is not a matter of immediate importance; but one which can be shelved until some future data, when all the shipyards and best marine engineering works will be filled up with Government orders for steamships and steam machinery.

Let us hope that the recent changes in the Emergency Fleet Corporation, whereby Mr. Chas. A. Piez and Mr. James Heyworth take over most of the duties of arranging and improving of the constructional work, will see something tangible done.

Not a little significance is contained in the following remarks, which we extract from an editorial-leader in our contemporary "Shipping World" of London for October 24th, dealing with the "Petroleum Bill," which will give the British Government the sole right to search and drill for oil in that country or to license persons or companies to do so.

"In the opinion of experts there is good reason to suppose that this soil of ours contains enough petroleum to make it profitable to bore for it and use. Certainly the oil-shale deposits in Scotland and elsewhere are paying concerns, and there appears to be sound justification for the optimism of the experts. Should petroleum be found in any large quantities—and **we have it on the authority of a leading shipping man in London** that so far the surface of the world has been no more than scratched—it is possible that **a great incentive will be given to the construction and running of oil-driven vessels at sea.** In any case, oil is used today for so many different things and enters so largely into the question of mechanical motive power that it is essential these islands should be made as entirely independent as possible of any foreign country for their future oil supplies."

If America continues building oil and coal-fired steamers, and Great Britain discovers large quantities of domestic crude-oil, as no doubt she will, it will be very serious for the success of our merchant marine in the future.

In ordinary times it has been almost impossible for American oil-fired steamers to compete against British coal-fired steam vessels; but, what will the position be **when American oil-fired steamers have to compete against British Diesel-driven motorships fueled with cheaply produced British oil?**

This prospect in itself should be sufficient to cause the Shipping Board to look ahead a little and to plan and lay down without further delay as large a fleet of steel motorships of the finest type available today as is consistent without delaying craft now actually building.

It is vital to the future of America's merchant marine that some motorships be built at once, and the proof of their superiority is so overwhelming that if those whom the country has entrusted the production of our fleet ignore the oil-engine vessel very much longer they hardly will be living up to the complete trust and confidence placed in them by our President and the people of this great nation. Ships, ships, and ships, is our slogan—and we must have ships that can compete with those of any other nation. Big Diesel-driven motorships are the only vessels that meet these requirements.

America needs and must have the most efficient class of cargo-ships it is possible to build to carry her products all over the world. An efficient ship necessarily is an economical ship. A steamship is not an economical ship, because it burns three to four times the amount of oil consumed by a Diesel-driven motorship and carries less cargo; therefore, it is not an efficient ship. Shall this country be saddled with a thousand and more inefficient ships? Or shall we have a thousand of the finest and most efficient vessels it is possible to obtain in these modern times and thus be able to compete with the world's maritime commerce?

CO-OPERATION IS NEEDED.

A BUILDER of Diesel engines says the reorganized shipping board has reinstated many plans rejected by the old board. Under the old regime, little consideration was given oil burners or heavy oil engines for new ships.

"Attitude of the new control in approving use of these systems, where possible, is a step in the right direction," says this engine builder. "It remains now for the shipping board to co-operate with oil companies in building oil tankers. Oil supply for the Allies has been narrowed to the American continent, and by the number of tankers and case oil ships destroyed it is evident Germany is concentrating efforts on cutting off this source of supply. Need of oil carriers grows with every American transport that reaches Europe. Without oil, many warships, destroyers, chasers, submarines, transports, aircraft and other military equipment are useless.

"Modern oil tankers are steel shells with oil-fuel steam engines. Fuel is carried in ballast tanks, or can be drawn from cargo. Coal-fired steamers are now obliged to carry enough coal for round trip, and this extra load reduced cargo capacity and earning power. Necessity for a more general use of oil burners is apparent.

"But a still further advantage is gained by use of heavy-oil engines. Only a few months ago Diesels, which are internal combustion engines, were rejected as unreliable. In refutation of this is the progress of foreign builders. German submarines use Diesels of upward of 1,000 horse-power each; French submarines use Creusot engines of 2,400 horse-power; Italy has Fiat engines of Diesel type of 1,300 horse-power and England has Diesels of 1,800 horse-power in submarines. Holland, France, England, Scandinavia and the Pacific coast have Diesel engines in ocean-going ships of 7,000 tons each.

"La France, which recently arrived at an American port, is nominally a sailing vessel, but has Creusot engines of Diesel type, and has made as much as 17 knots. This vessel has been trading for a few years between France and South Sea Islands, but is now too valuable for that service and is to take up the Atlantic service."

"Diesels can be built in America as well as in any other country, but we are only commencing. We should benefit by foreign experience. Chemists have opportunity to develop a metal to stand the enormous heat and pressure. The Diesel is growing in public favor and is getting a good introduction to the navy department. The 'Maumee,' an American naval tanker, has the second biggest Diesel equipment in the world; each engine is 2,500 horse-power."—Oil and Gas News.

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The Application of Electricity to Auxiliaries on Shipboard

By H. L. Hibbard, Esq., Member Society of Naval Architects and Marine Engineers

FOR the past several years the attention of the Society has been invited at intervals to the application of electricity in various forms to vessels in both the naval and merchant service. Mr. Donnelly some years ago described his proposed electrically operated ship "Electra." Mr. Emmett has presented several papers on electrical propulsion, particularly with reference to its application to naval vessels. Developments have recently been such, however, that the time seems opportune for the consideration of the general application of electricity to merchant vessels, not only as to the possible advantages gained in their propulsion, but particularly also to the operation of their auxiliaries, in the light of results already attained and installations contracted for.

The marine engineer and the seafaring man in general are naturally conservative in the adoption of new and untried apparatus. The time is rapidly approaching, however, if not already here, when the results obtained will justify the construction generally of vessels electrically equipped in all or many of their power applications. It is here interesting to note that in the use of electricity the American Navy has not only been far in advance of the merchant marine, but, we believe, has led all navies of the world. Europe, however, seems to have led this country in the trial of electrical apparatus for auxiliaries on merchant vessels.

Two or three years ago, the "Christian X" created much interest on its first voyage here with its oil propelling engines and electrically operated auxiliaries. Similarly, last winter, the "Chile," constructed by Burmeister and Wain, was visited while in New York harbor by many marine and electrical engineers. This vessel, of 13,400 tons displacement and provided with oil engines of a total horsepower of over 3,000, was equipped throughout with electrically operated auxiliaries, both for engine-room and deck machinery. Three Diesel engine-driven, 60-kilowatt generators furnished direct current to the auxiliaries at 220 volts. We understand, however, that one of these generating sets was sufficient to supply auxiliary power while at sea, and two were used while handling cargo in port. At least one generating set was, therefore, always available as spare.

In the engine-room equipment were included motor-operated ventilation fans, motor-driven centrifugal, circulating water pumps, bilge and sanitary pumps, ballast pumps, engine-turning motor, motor for operating tools in repair shop, etc. In the deck equipment, electrically operated steering gear, deck winches and anchor windlass were provided.

As far as we have been able to ascertain, the result of the operation of these equipments has been in every way satisfactory on this vessel, and an interesting article as to the general performance of the vessel was contained in the February issue of Motorship. In a visit to this vessel the writer noted with particular interest, in the limited time available, the construction and distribution of the electrical equipment, and although it was perhaps somewhat clumsy in design, measured by our standards, it was certainly ruggedly constructed and, as far as we were able to learn from the engineers in charge, it appeared that they were well pleased with its performance and had encountered no particular difficulties.

In this connection we would draw attention to the influence which the growing use of oil-operated engines has on the adoption of electricity for ship auxiliaries. An article appearing in the March issue of Motorship by Mr. G. E. Smith, chief engineer of the American Engineering company, reviews this situation and makes the significant remark that "the writer is firmly of the opinion that within a very short time all auxiliaries on motorships will be electrically driven."

The Wm. Cramp & Sons Ship and Engine Building company, holding patent rights under Burmeister and Wain for oil-engine construction, decided on their own initiative, the first of this year, to construct a very similar vessel to the "Chile," and we had the pleasure of figuring on the electrical equipment for its auxiliaries, which were generally similar in number and horsepower to the "Chile's" but, we believe, would have been improved in certain details of construction. Unfortunately, however, the Government, having commandeered this ship with all others, was unwilling to allow the Cramp company to install the oil engines and electrical auxiliaries contemplated; we presume in view of the fear of being unable to obtain such apparatus within the time desired.

At last year's meeting of the Society, a paper by Mr. Frear was presented covering a description and results obtained from the oil tanker "La Brea," which was apparently the first instance of electrically operated cargo pumps on a tank ship, and, as indicated in Mr. Frear's paper, the results were very gratifying, particularly when compared to her sister ship, the "Los Angeles," equipped with reciprocating engines and steam pumps in comparison to the geared steam turbine and electrical pumps on the "La Brea."

Among the most striking examples of the use of electricity on merchant vessels are the boats being constructed and projected by the Pennsylvania Shipbuilding company at Gloucester City, New Jersey. This company has under construction six tank steamers of about 7,500 tons displacement, one of which is nearly completed and another will take the water shortly, which will be propelled by geared steam turbines and their auxiliaries operated by electricity throughout. The electrical equipment on each of these vessels will consist of the following:

2 100-kilowatt 3 phase, 60 cycle, 220 volt, steam turbo generating sets.
1 anchor windlass, 25 horsepower slip-ring type motor.
1 forced draft fan, 25 horsepower slip-ring type motor.
1 steering gear equipment, 15 horsepower squirrel cage type motor.
2 cargo oil pumps, 80 horsepower squirrel cage motors, 3 speed, pole changing.
2 deck winches, 15 horsepower, squirrel cage type motors.
1 warping winch, 15 horsepower squirrel cage type motor.
1 oil transfer pump, 5 horsepower squirrel cage type motor.
1 forward bilge pump, 5 horsepower squirrel cage type motor.
1 bilge pump for pump room, 5 horsepower squirrel cage type motor.
1 circulating water pump, 5 horsepower squirrel cage type motor.
1 workshop motor, 5 horsepower squirrel cage type.
1 refrigerating plant, 5 horsepower squirrel cage type motor.
1 oil tank ventilation blower, 5 horsepower squirrel cage type motor.
1 fresh water pump, 5 horsepower squirrel cage type motor.

In addition to the above tankers, two cargo vessels of 12,000 tons displacement will soon be laid down and which will have an equipment of auxiliary motors similar to the above tank vessels with the exception of the deck winches, which will consist of three of 25 horse-power and eight of 15 horse-power. It is further contemplated that these two cargo vessels will be electrically propelled and operated by two turbo generating sets, each set furnishing current to a 1,500-horse-power motor, the two motors being geared to the single propeller shaft.

In addition to these vessels, this company contemplates the construction also of six cargo boats propelled by geared steam turbines and with electrical auxiliaries similar to the above.

For the above vessels open-type alternating current motors will be provided throughout and watertight enclosing cases furnished for the deck motors, with the particular view to protecting them from exposure to moisture; but the cases can be removed, if desired, when the vessels are in port, to give the motors ample ventilation.

The majority of the motors will be operated from a common switchboard in the generator room, and in most cases no means is provided for starting or stopping the motors at the auxiliary. A particular exception is the case of the anchor windlass having its controller near the motor on deck.

It will be noted that alternating current has been employed throughout on the above vessels, and those advocating the same point to the necessity, in the case of the tank vessels, of using the alternating current squirrel cage type motor with its freedom from moving contacts in places exposed to the possible presence of oil vapor. With the same object, the controlling devices, as described above, are all centralized in the generator room. On these vessels also an interesting form of deck winch is used for the first time, employing a constant running motor and a set of planetary gears, so arranged that, by the operation of a lever and two brake bands, the load can be stopped or the speed of the winch varied while the motor continues to operate at constant speed.

In contrast to the alternating current used on the above vessels, the Texas Oil company is soon to construct a tank vessel of approximately 6,000 tons displacement, propelled by fuel oil engines and provided with direct-current, 230-volt motors on its auxiliaries. The principal auxiliary equipments on this vessel will be as follows although a few additional will probably be eventually supplied:

6 30 horsepower variable speed cargo pump motors, enclosed type, variable speed.
1 20 horsepower fire-room bilge pump motor, enclosed type, constant speed.
4 5 horsepower constant speed, enclosed type motors for operating auxiliary pumps.
2 refrigerating machines, 3 horsepower enclosed type motors, variable speed.
1 10 horsepower steering gear motor, open type, constant speed.
2 cargo deck winches, 20 horsepower enclosed type, compound wound.
1 20 horsepower capstan, open type compound wound.
1 25 horsepower windlass, enclosed type, compound wound.

The six cargo pump motors and the bilge pump motor, all we understand located in the same compartment, will be operated from controllers on a common switchboard in the generator room, similar to the arrangement for the Pennsylvania Shipbuilding company's tankers. In addition, however, watertight pushbutton stations will be located adjacent to the motors which will stop the pumps when desired, to be again started from the generator room. The cargo pump motors and the motors exposed on deck will be probably provided with enclosing cases, furnished with forced ventilation, or this forced ventilation carried directly into the enclosed motor frames.

While it is not here the intention to discuss in detail the relative merits of various kinds of motors, it may be mentioned that in comparing the direct-current with the alternating current equipments mentioned above, a saving in wiring, flexibility of speed control, and improved speed and torque characteristics for the deck auxiliaries are on the side of the direct-current equipments. The alternating-current motor, as pointed out above, has the advantage of freedom from moving contacts and the reduction, in consequence, to a minimum of the possibility of sparks in places where inflammable gases might be encountered, as in the case of the tank steamers. This, however, applies particularly to the constant speed, squirrel-cage type of alternating-current motor, the slip-ring type of motor which is required for some applications being provided with moving contacts.

In connection with the electric propulsion of ships, it is interesting to note that, in addition to the very considerable number of electrically propelled ships now being constructed for the Navy, this mode of propulsion is receiving considerable attention in its application to merchant vessels. In addition to the two cargo vessels at the Pennsylvania Shipbuilding company's plant, which it is expected to propel electrically, we are familiar with electrical installations on four oil barges under construction at New Orleans by the Petroleum Transport company. These boats are twin screw, each propeller being driven by a 300-horse-power, 480 volt, 3-phase, 60-cycle motor, the two motors being operated by one turbo generating set of similar voltage and frequency. These motors are operated by automatic contactor controllers from a common master station, two control levers giving straight-line motion similar to the valve levers of the usual reciprocating engine installation.

While the geared steam turbine has shown some excellent results and the use of the heavy oil engine for propulsion purposes will probably be more extended—and possibly Mr. Emmett has, under these later developments, modified his views somewhat regarding electric propulsion—it will be seen from the above that this feature of electrical application on shipboard is receiving continued attention and its further application is to be predicted.

A combination which may receive a good deal of consideration in the future in this connection, especially for equipments of average size, is the operation of one or two generating sets by oil engines instead of steam turbines, the generators to operate the propelling motors as at present. Such an arrangement provides the advantages of the use of fuel oil, at the same time retaining the flexibility of the electrical drive and permitting oil engines to be furnished without reversing features.

We have thus seen some of the progress which has been made in this application of power in the merchant field, and we feel certain that its application by this time would have been considerably more extended had not the war conditions necessitated, at least in the opinion of the government officials, foregoing consideration of electrical apparatus in favor of steam in order to produce a merchant fleet in the shortest possible time. The progress made, however, is noteworthy, especially in view of the opposition which has been encount-

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ered to the use of electricity until recently from many of the steamship companies, shipyards and manufacturers of steam apparatus. The writer recalls with interest some years ago one of the head officials of a large shipyard, manufacturing steam auxiliaries as well, advising frankly that he would use every effort to defeat the installation of electric auxiliaries on a large freight vessel which was then under contemplation. We are pleased to believe, however, that such attitudes are changing rapidly.

We feel it is unnecessary at this time to refer in detail to the wide application of electricity in the American Navy or to the very satisfactory results which have been obtained from practically all of the apparatus so driven. This at least, in a general way, is thoroughly known by members of the Society. It has been stated frequently in the past, however, that results could not be expected on merchant vessels similar to those obtained in the Navy, owing to the much higher class of operators on naval vessels and that the average freight vessel did not carry men in any way familiar with electrical apparatus. The remark has often been heard also in connection with a contemplated vessel or one under reconstruction, that the general use of electric power would require a generating plant of possibly 100 kilowatts, whereas the generators which we have or had expected to purchase are of 10 or 15 kilowatts.

The above situation is mentioned in the hope that it may be possible in the near future to create a new atmosphere of thought in the minds of the steamship lines, naval architects, etc., as it is obviously essential that a ship using electricity to any extent should have a power plant of equivalent size, and also that such vessels should be provided with at least one operating engineer, who is sufficiently versed in electrical matters to be able to make slight adjustments and repairs in the same way that steam engineers can readily repair broken parts of steam machinery and consider the same merely as a part of their routine duty.

In addition to the advantages which have been considered and resulted from electrical installations on naval vessels, numerous specific advantages are apparent in connection with such installations in the merchant marine, including frequently a saving in space and weight in the installation of the auxiliaries themselves, a very much higher efficiency of operation, and consequent saving in total fuel consumption, the elimination of long and objectional lines of steam piping, which on certain classes of cargo vessels are nearly always installed above deck and result in continual steam condensation; also, on certain of the auxiliaries, particularly those requiring varying speed and load conditions, the electric motor offers some distinct advantages over the use of the steam engine.

Time has not been available for the writer to prepare detailed data and illustrations to accompany this outline of the present situation and we have felt in fact that, owing to the considerable number of installations now being effected, more interesting and valuable data could be submitted for the Society's information at one of its meetings in the near future, after trials of a number of the vessels now under construction have been made. Should it therefore be the wish of the Society, the writer will endeavor to present such additional information and detailed data at a future meeting.

Read by the author before the Society of Naval Architects and Marine Engineers at the twenty-fifth annual meeting and published in Bulletin No. 9 of the Society.

FLOWER MOTORSHIP COMPANY, LTD.

At an extraordinary general meeting of this company it was unanimously resolved voluntarily to wind up the concern. The chairman, Sir Marcus Samuel, who presided, stated that two of the three motorships they had built had been torpedoed, leaving only one running. **That, however, was doing splendid work, and her Diesel-engines were maintaining a speed much beyond the contract rate.** Although they were taking this step, he would like to emphasize that the theory which had actuated the foundation of the enterprise had proved correct. **They had established beyond doubt that the internal-combustion-engines possessed advantages of the most material kind over the steam-engine.**

As an instance, he might say that motorships of that class had been awarded under arbitration a rate of 12s. 6d. per gross registered ton on Government work, against 11s. per ton paid for identical steamships of the old type. If the ships had been burning oil in their furnaces under the old system they would have consumed at least four times the quantity they used in their internal-combustion-engines. The chairman stated that **the shareholders had performed an important national service,** and fortunately without loss to themselves. They might even expect to get a trifle more than the capital subscribed and meanwhile had received dividends. [One or two of these motorships referred to were used for a time as patrol-boats in the North Sea, during which duties one, the "Abelia," was torpedoed. They are steel ships of 5,600 tons d. w. c. and of 2,240 i. h. p. in twin-screws.—Editor.]

NEW YORK SHIPBUILDING CORPORATION TO BUILD MOTORSHIPS.

In an interview published in the N. Y. "Evening Mail" for Oct. 15th, Mr. H. A. Magoun, vice-president of the New York Shipbuilding Corporation of Camden, N. J., stated:

"The New York Shipbuilding Company has twenty-one ships under contract, two of them being passenger and freight steamers for W. R. Grace & Co. and two being freighters of 10,000 tons each for the Atlantic Transport Company.

"One of the most interesting developments this great concern has made is the practical completion of a shipway that will one day witness the laying of a 1,000-foot ocean greyhound. This ship is practically contracted for, and will be the largest vessel ever built in this country. She will be followed quickly by the construction of two sister ships, and it is generally understood that the giant liners will fly the house flag of the American line.

"The New York Shipbuilding Company expects to build motorships when normal conditiins return, and officials of the concern are confident that they have an engine of this type that will give complete satisfaction."

ITALY AND HER SAILING SHIPS.

Owners of sailing-ships in Italy have been advised by their Government that their craft will be requisitioned unless suitable oil-engines are installed, in which case the vessels will be requisitioned for a period of twelve months. Similar steps should immediately be taken by the U. S. Shipping Board, as we previously have recommended; but the subsidy of $25 per b. h. p. should be made because of the existing high prices of oil-motors. The dearth of shipping makes it vitally important that the annual carrying capacities if all American sailing-ships should thus be increased and the Italian Government has set an excellent example. It seems as if Great Britain will follow suit. Let not America lag!

85,000 Brake-Horse-Power

in EIGHTY Internal-Combustion Heavy-Oil Engines (Two-Cycle Type) Built by the

Fiat-San-Giorgio

(ITALY)

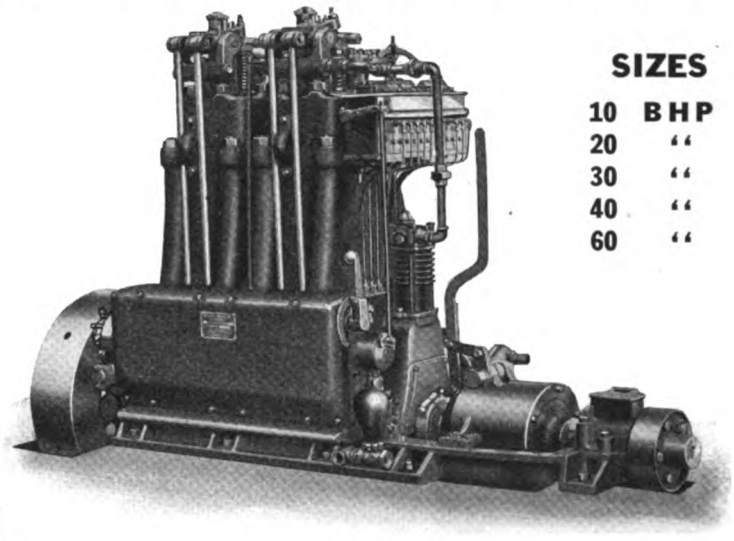
already are in USE, and the hard war-service, on the submarines and auxiliary ships have **proved** their good qualities.

The FIAT-SAN-GIORGIO, after satisfactory results with the two 2300 b. h. p. motors in the Brazilian submarine mother-ship "CEARA" (384 b. h. p. for each cylinder) now is constructing a large number of standardized motors of 1000 b. h. p. for cargo-ships, and motors of 400 b. h. p. for auxiliary sailing-ships.

FIAT-SAN GIORGIO—Capital, 22,000,000 Lires fully paid.

SHIPYARD: Muggiano (Spezia) **Eight** ships up to 700 ft. length, and **Thirty** submersibles can be built contemporaneously.

ENGINEERING WORKS: Turin (Via Cuneo 20) Internal-combustion motors of any size are built.



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NO Carburetor, batteries, magneto, blow torch, hot ball or hot surface.

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Cast Iron for Oil-Engine Cylinders

Notable British Engineers Discuss This Important Subject.

WHAT we would like to see in this country would be a society devoted to marine internal-combustion-engines, where the design, construction and operation of all types of marine motors could be discussed by designers, manufacturers, architects, shipowners, boatbuilders, and shipbuilders. The American Society of Automotive Engineers is making excellent endeavors along this line; but nine-tenths of the members are automobile men, so discussion on motor car construction must predominate at its meetings. There is urgent need for such a society, and we see no reason why one could not be formed, possibly in co-operation with the Society of Automotive Engineers, and with such arrangements whereby their building could be used as headquarters.

As we mentioned in our last issue, to further the marine oil-engine industry there has been formed in Great Britain an association known as the British Marine Oil Manufacturers, and the temporary chairman is Mr. J. A. Milton, chief-engineer to Lloyds' Register of Shipping. Promotion of the industry will be assisted by the mutual interchange of experience, for standardizing designs as far as practicable, and for carrying out such investigations and research work as may be necessary for the proper development of this type of machinery. There also has been formed in that country an association known as the Diesel Engine Users' Association, which already has done some very valuable work for all those concerned.

There is in America the Society of Naval Architects and Marine Engineers which really has done very little to promote and develop the marine oil-engine and motorshipping industries, so obviously what is needed is a separate organization solely devoted to all phases of motorship development.

In England the Institute of Marine Engineers, also the Northeast Coast Institute of Engineers, have done some splendid work on behalf of marine internal-combustion-engines and motorships, and at all these meetings Lloyds' Registry of Ships seem to have been very active, in fact their chief-engineer, Mr. James T. Milton, himself has read some very valuable papers on the subject, and is becoming one of the foremost Diesel experts in Great Britain.

Recently a very interesting discussion of cast-iron for oil-engine cylinders was held by the Institute of Marine Engineers, of London, Mr. J. T. Milton being in the chair. We reproduce this discussion, which we have been obliged to condense and cut owing to pressure on space:

Mr. Timpson: In introducing a discussion on this subject, the difficulties experienced with the internal combustion engine are suggested and the reliability of cast iron for various parts to withstand the heat and pressure, I can only say that there seems no definite mixture for certain purposes, one item being the tops of hot-bulb engines. Some will stand 12 months, and work quite well; others will not stand more than a fortnight. This does not seem to be the case only in this country, but also in engines of Continental make, they may have more tests for cast iron but are evidently up against the same trouble. In fact, bulbs of foreign origin have been replaced by British productions, and these have stood better. But there does not seem to be definite knowledge of the mixture required of this very important detail. As regards hot-bulb type engines, the same applies very much, as the Chairman mentioned, in regard to cast iron bodies under superheated steam, in some cases the casting will stand for a long period, often this is not the case; therefore, generally speaking, it all points to more knowledge being required of a metal—which is so useful to engineers.

The Chairman: You were referring to hot-bulb engines. It gets to a dull red heat.

Mr. Timpson: It is a most drastic heat for any metal to stand, and cast iron stands it best. Cast steel seems to burn out more rapidly. In regard to the cast iron bulb, some engine makers seem to have been fortunate in obtaining a good mixture which stands a long period, while others have not done so well; that, I suppose, is purely a question of a lucky hit, and not of research, for which it is evident there is considerable scope to the general good.

Mr. A. H. Mather: Can the same foundry be relied upon to cast exactly the same material regularly and without that slight variation which brings about trouble.

Mr. Timpson: So far as I have been able to gather information on the subject, the foundry referred to has supplied regularly a reliable mixture to produce satisfactory castings.

Mr. W. P. Durtnall: The question of cast iron is of the highest importance to this country. The use of cast iron in connection with internal-combustion-motors has been found very satisfactory, and is still being used in a great many cases of heavy land, marine and automobile type engines, but, with the exception of cylinders and pistons, its use is not desired in connection with the frames and other main parts, whilst in connection with operating gear and other essential features the use of steel has been more favored, and the use of "cast steel" is now predominating in modern designs, because of its greater strength and lightness for given strength. I would say that when it comes to system of construction, and the materials used for same, there can be no laying down of fixed hard and fast rules, for sufficient reason that the suitability of any given material is governed by circumstances of application and operating conditions, and weight per unit power developed, and which demands are ever varying.

For stationary engine design and construction cast iron offers a cheap and easy method of construction and machining, but when it comes to the design and construction of prime-movers for all kinds of transport work, including marine engineering, cast iron does not present such a satisfactory solution to the problem, owing to its high weight per unit strength, and it is quite noticeable that the most advanced designers and constructors of high-power marine internal combustion engines are embodying the use of steel wherever possible, on account of weight, which has to be carried, and every ton of extra weight means a ton of extra displacement to be dealt with in connection with the propulsion of the vessel, which again reflects on the fuel consumption per unit live ton-mile, or given voyage.

A tribute must, however, be paid to the metallurgists and manufacturers on account of the great improvements that they have introduced in the cast iron available for cylinders and pistons of recent years, with the high tensile and good ductility, and these qualities being very noticeable, but I am of opinion that cast iron will experience a great competitor in the immediate future from the superiority of good aluminum alloys for much constructional work, especially bearing in mind that this material can be cast in so many designs and with such great ease, and clean drawing, etc. Cast iron suffers also from loss of tensile strength, which begins to decrease as the temperature rises; beginning at say 200 degrees Fahr., at a temperature of, say dull red, about 1,000 degrees Fahr., its strength is reduced to about one-third, falling to Zero strength at about 1,240 degrees. This at least indicates the importance of water cooling the exhaust pipes and working cylinders and pistons of high power gas and oil engines, etc. It also indicates the difficulty of using cast iron for operating conditions where these temperatures are attained, and where internal pressure may be excessive, and on permanent work, or in connection with superheated steam, even with steel, the strength is reduced considerably with a rise in temperature.

Cast iron derives its characteristic qualities from the impurities present; to a certain extent these impurities are the same as those in steel except for graphite, which is one form of carbon. The carbon is always present in two forms, namely: (1) combined carbon in the form of cementite; (2) uncombined carbon or graphite. The total carbon seldom exceeds 4. per cent., or falls below 3.25 per cent. The larger the proportion of carbon in the combined state, the harder and more brittle will be the metal. Silicon is a desirable impurity, because it tends to precipitate carbon in graphite form; about 3 per cent of silicon gives the best results. Sulphur has the opposite effect of silicon, and is undesirable. Manganese increases the total carbon and also the proportion of combined carbon, but tends to neutralize the similar effect of sulphur. Phosphorus, if present in sufficient proportions to be chemically active, tends to hold the carbon in combined form, and also tends to weaken the metal.

I am of opinion that, as progressive marine engineering proceeds along the time, that a general application of steel construction is essential to the well-being of the British shipping industry. I think that the pig iron should be made into steel, and not cast iron, as this is the metal which must be used for the construction of all kinds of machinery in the future, if Britain is to hold her own, against the Continent of Europe and America in the great field of engineering, and marine engineering especially. Steel is the coming metal, and after this great struggle of military activity is over, then will be the period when Britain may be forced to see that it will be in her converters that her might will be maintained, and may I propose that the members of our splendid institution may not be the last to give full appreciation to the fact? When the great coming war of commercial enterprise is opened, may British marine engineers rise to the occasion, and still retain the principal carrying business of the world.

Mr. Jas. Wells: It is a very good thing to have one's attention called to the common things of engineering practice, and so be able to realize the value of the advances that are being constantly made in every field of work. Cast iron is one of these very common things used every day by engineers for the widest possible variety of work. In the past (if not at the present time) reliance has been solely placed upon the skill of the founder to obtain the particular result required. This method of trial and error is, of course, a very costly one both of labor, of time involved, as well as the uncertainty of any given result being attained. The modern method has been first a search into the connection between cause and effect by means of careful experiment, and this search has given excellent results so far. The refined and improved means of measuring high temperatures has contributed very largely to this result.

Most of the experiments were made formerly in the works, where some new difficulties were encountered in the course of fulfilling some order. In such cases, from a lack of experience in the art of experimenting, someone who carried the most influence would suggest a certain mixture of metals, and this would be tried; if it did not give the result wanted another shot would be made at the required mixture and the work done over again, and so on until the result required was approximated to, as closely as time and money would allow. If the result obtained was satisfactory, then there was an end to the matter, and no record would be kept except that of memory, but if the end was not quite as satisfactory as desired, well, then, any similar order in the future would be allowed to go to some other fellow to "burn his fingers with," etc. Data obtained in such experiments are in no way reliable upon which to base any inferences for future use.

Another very common failure on the part of experimenters when devising a series of experiments is to overlook the necessity of arranging for the change of one variable only at a time, so that the influence exerted upon the results obtained by each can be immediately traced to the source without any doubt, otherwise it is extremely easy to attribute the result to any but the correct source or sources. Much time has been wasted over the so-called paradox that different values of the Modulus of Elasticity may be obtained experimentally according to the way the tests are made—that is, by a tensile test or bending test, but if the basis of the formulae were understood such discussions would be impossible. The assumption made is that the stress does not exceed the limit of proportionality of stress to strain, for no formula is possible when the rate of stretch ceases to be proportional to the stress.

In the case of cast iron it is exceedingly difficult to establish the yield point, but before failure takes place usually it is quite possible to determine E. In the case of bending tests it is the practice to use the bars as they come from the foundry, and then their section is not uniform unless they are machined, so that it is not possible to calculate the value of the moment of inertia exactly because of the varying section, but if the difference between the average value and that at any section is small, then if the deflectors are measured per increment of load a very satisfactory value of E. may be obtained, and results that are concordant with the tensile tests upon the same sample. With some of these points in mind the results of the hardness tests will be more intelligible. The Brinell test imposes a steady load, whilst the Shore is an impulsive load, and this suggests the difference between a press for forging and a steam hammer.

Great advances have been made in the field of cast iron, and still greater will be made.

Mr. Newton: As high a temperature as 600° has been mentioned. What would become of the lubrication at such a temperature? I know of one

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engine running with red hot piston head, and we were using a mineral oil. The cylinder liner was not hot. There is no lubrication that will stand such a temperature.

Mr. A. H. Mather: And some of the lighter oils stand it also, it is not necessarily the heavier oils only. There is one paragraph of great interest to me, where reference is made to the action of heat on cylinder liners either in internal combustion engines or when using superheated steam, and the theory of the growth of cast iron under these conditions provides food for thought as to how far this may prove to be a cause of cylinder troubles. Usually when cylinder trouble occurs, the first attitude adopted is "blame the oil," and should the growth theory prove to have some foundation in fact, it would provide a good alternative reason for a scored liner when such a mishap has to be accounted for.

Mr. Timpson: You will find some piston rings wearing for years, and the next disappearing very quickly. Some get very drastic treatment in springing them over larger piston bodies to get into place, and stand it—others fail, all showing differences in the characteristics of the metal.

The Chairman: What is the spring in the ring when the temperature is 700°? It is not in contact with water, and is probably hotter than the cylinder liner.

Mr. Timpson: You will find in some two-cycle engines that the rings will run from 12 to 15 months, and be quite good. Silicon induces coarse grain, on account of the graphitic carbon developed; this causes decay to occur more readily, as explained in a paper read by Mr. Milton before this institution in 1908.

Very high silicon alloy cast irons, with no free carbon, are quite immune from corrosion or action of any acids whatever. Such special cast irons are only useful for chemical plant, as they are extremely brittle, have very large shrinkage, and cannot be machined.

In castings for engine work each part should have the right mixture of iron for its particular purpose—liners should be of a different grade to pistons and cylinder heads, but it is not possible always to arrange this, and the engine maker is more favorable to a mixture which will machine well. I should like an opinion on the now general use of from 15 per cent and 25 per cent of steel scrap added to the cupola charge, in order to get close grain castings and additional strength; or is a casting made only from selected brands of pig preferable. Titanium, vanadium and other alloys are also favored by some founders.

The following notes on iron castings, furnished by an expert metallurgist, may be a useful guide:

Combined Carbon.—The actual amount of total carbon varies very little, but its condition varies very much. Maximum general strength is obtained with 0.6 per cent combined carbon present. Low silicon and quick cooling increases the combined carbon, high silicon and slow cooling decreases it. The thinner the casting the higher the silicon necessary.

Graphitic Carbon.—A casting is soft, according to the percentage of graphitic carbon present; this percentage is conditioned by the silicon, sulphur and manganese present, also by the rate of cooling. Graphite in large flakes makes the casting weak; low silicon and quick cooling lessens the size of the graphite.

Total carbon should be low for the best tests, but an iron with low total carbon has increased shrinkage. Castings left a long time in the sand after casting will be softer than those stripped immediately after casting.

Phosphorus.—If over 1 per cent, rarely gives good tests, and is a probable cause of failure; 0.6 per cent will give fair results; 0.4 per cent is very much better.

Sulphur should not exceed 0.25 per cent in the casting; tends to increase hardness but to decrease strength.

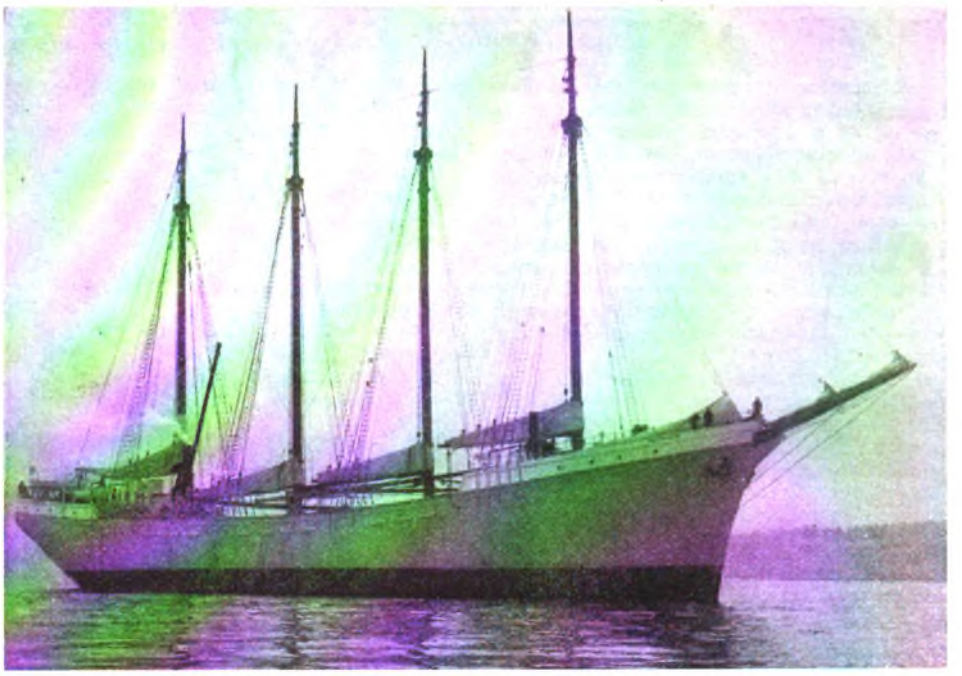
Manganese should not exceed 0.75 per cent; it stiffens the test bars and gives low deflection in the transverse tests.

Silicon, the most important element to watch, may vary from 1.25 per cent in heavy castings to 2 per cent in medium. In test bars 1.75 per cent to 2 per cent gives about the maximum strength.

FAST MOTOR FREIGHTERS.

From the Shipping World (London) of Oct., 1917.—It is stated that no fewer than seven motorships of large tonnage are building at Belfast to the order of two British lines. Of these four are 10,000-ton to 13,000-ton ships, to have a speed of 13 knots, and three are 10,000-tonners, to have a speed of 10½ to 11 knots, all to be fitted with four-cycle Diesel engines.

The Auxiliary Motor Schooner "Risor"



THE "RISOR," EQUIPPED WITH TWO 240 H. P. MIETZ OIL ENGINES

THE motor auxiliary "Risor," the fifth four-masted auxiliary schooner and sister ship to the "Tacoma," "Portland" and the "Remittent," which was described in the November issue of Motorship, had her trial trip on November 20. The trials were entirely satisfactory to the owners, the Alex. Prebensen Company of New York. The average speed for 6 hours was 7½ knots. The following is an account of her log:

A. M.—
10:28 Left shipyard.
10:38 On course, full speed ahead. Engine 220 r. p. m.
10:55 Bell buoy.
11:26 Alki Point.

P. M.—
12:54 Pully Point.
1:02-2:22 Maneuvering.
2:22 Full speed ahead.
2:26 On course.
2:41 Pully Point.
3:43 Alki Point.
4:20 Slow bell.
4:38 Fast at shipyard.

Remarks: Strong S. W. wind going south, calm on the way back.

The engine responded to the bells quickly and practically no difficulty was evidenced on the trip, which was under the direction of Capt. C. A. Call.

The "Risor" is 250 feet in length, 43 feet beam and 21 feet draught with a carrying capacity for 2,600 tons. She is equipped with twin 240 h. p. Mietz engines. Aboard the "Risor" is a set of the Edison cells which were described in the last number of Motorship, used for auxiliary lighting. They are 100 in number and are catalogued B. 4 H., having a capacity of 75 ampere hours at 120 volts, which on one charge will light 20 forty-watt lamps for twelve hours. These sets are fast becoming standard equipment on a great number of vessels of this type on the Pacific Coast.

NEW MOTOR VESSELS BUILT BY THE COLUMBIA ENGINEERING WORKS.

The motor schooner "Diria," which was launched from the yards of the Columbia Engineering Company of Portland, Ore., in October, has completed loading a cargo of lumber on the Columbia River for San Salvador. She is owned by the American Manganese Mining Company. After discharging her cargo the "Diria" will proceed to Costa Rica to take on a cargo of ore for Philadelphia. Here she will be equipped with twin Craig oil engines of 300 b. h. p. each The "Tempate," also built by this company, has already sailed with a cargo of lumber for the same destination. She will also take on ore at Costa Rica and from there will proceed to Philadelphia, where she will be equipped with Wolverine engines shipped from the factory at Bridgeport, Conn. The "Tempate" is owned by M. T. Snyder of New Orleans.

The "Chiquimula" will take the water in a few days. She is to have Wolverine engines installed also.

Recent orders for ships accepted at the Columbia Engineering Company include two auxiliary schooners for Christoffer Hannevig of New York and will be of the same model and type as the Snyder vessels, though slightly larger, being 180 feet on the keel, whereas the Snyder ships are 170 feet.

THE TANKSHIP SITUATION.

For months "Motorship" has advocated the rapid construction of tankships, particularly Diesel-driven vessels, and we are glad to see that the U. S. Shipping Board Emergency Fleet Corporation is going to build fifty-eight tankers as quickly as possible, and to consider constructing forty more. We presume that they will be steam-driven, contrasting with the policy of several important European owners of tankships.

JAPANESE SUBSIDIES TO FISHING-BOAT BUILDERS.

For eleven years builders of motor-fishing boats in Japan have been enjoying an excellent subsidy from their Government. A bounty of no less than $10 per b. h. p. for each oil-engine installed is paid in addition to $15 per ton gross for each wooden boat. Among crude-oil engines installed are the Mietz & Weiss (American); Bolinder (Swedish); Dan (Danish); Griffin (British), and among kerosene motors are the Union (American) and Gardner (British). Many Japanese oil-engines now are fitted, and out of 406,889 fishing boats in Japan, 2,748 are motor-driven, the total power being 48,631 b. h. p.

CRAMPS BUY DE LA VERGNE MACHINE WORKS.

We learn that the De La Vergne Machine Works, of New York City, have been purchased by the Wm. Cramp Ship and Engine Co., of Philadelphia. Controlling interest in these large oil-engine works were owned by Dr. Köerting and has been on the market since the war started, Dr. Köerting having retired from active business. The capital was $1,500,000 of which he owned about 55%.

It will be interesting to see if the Cramp Company build the Burmeister & Wain Diesel engine, for which they have license, at these works, or if they will proceed with the construction of the new marine oil engine which the De La Vergne Co. have been developing for some time past, and for which a number of orders are on hand.

GOOD PRICE FOR LITTLE MOTOR VESSEL.

The wooden motor cargo-boat "Eucrate," which carries 150 tons d. w., has been sold by her owners, Messrs. Robertson, Shankland & Co., Ltd., of London, for $18,750.00. She is equipped with an oil-engine.

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Electrification of Auxiliaries in the Merchant Marine

By C. G. SCHAFER

Industrial Division of the Westinghouse Electric and Manufacturing Company

THE electrification of merchant marine auxiliaries should in no sense be regarded as an experiment or as a proposed scheme that possesses certain alluring features. On the contrary, it should be viewed as a further development of electrical application and should receive the serious consideration and hearty cooperation of the marine profession, as it is apparent that the application of electrical power to shipboard appliances will be attended with the same marked success and efficiency as has been the case with its adoption in all land appliances requiring motive power.

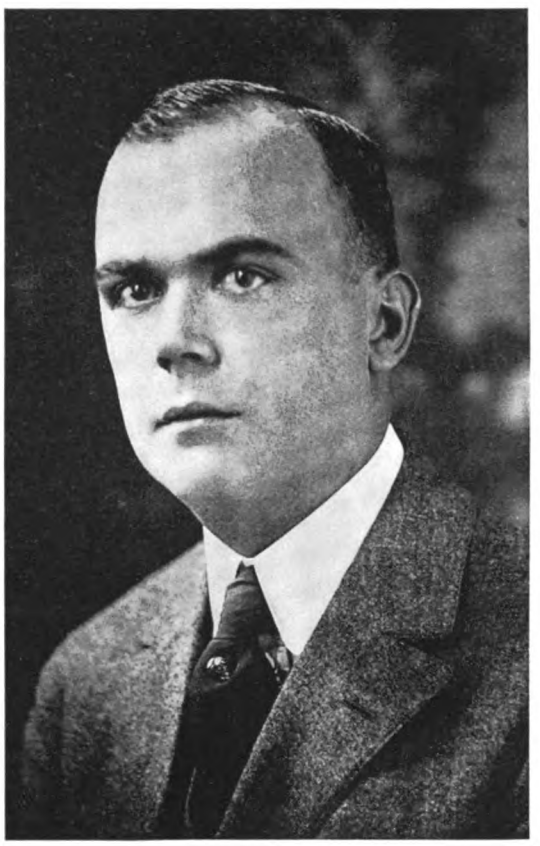
While there are numerous instances of earlier applications using electric power, it is only approximately twenty years ago that the industry began to assume a strictly commercial basis. Since then the remarkable feature has been the rapidity with which the electric motor and generator have been universally applied. Even in the memory of the young engineer it will be recalled what a rare spectacle it was to see an electric motor driving a machine or a set of line shafting. However, farsighted men began to use the motor for general and specific purposes. Its advantage and general efficiency were soon learned and its future became permanently established. The first motors. however, were crude, large, of limited capacity and expensive, and in many instances these handicaps caused the skeptics to adhere to the older and less efficient methods of drive. The first cost and maintenance of the older types were in many cases, prohibitive, a 50 h. p. motor costing approximately $1,500, as compared with $400 for the present day design. With the present design of motors and generators, the undesirable features have been eliminated, and the art has progressed to such a degree that one is safe in stating that there is not an application that cannot be electrically driven. Today there is not an industry in which electric power is not used to some extent, and there are many in which all processes are accomplished by means of electricity in one of its forms, i. e., heat, light, electrolytic, magnetic, or mechanical power.

Considering mechanical power only, the range of applied horse power extends from the modest 1/50th h. p. ventilating fan motor and 1/30th h. p. family sewing machine motor, weighing approximately 8 to 10 pounds, to the large hoisting motors of 2,500 h. p. and weighing approximately 200,000 pounds, and the large reversing mill motors having a rating of 15,000 h. p. and weighing approximately 700,000 pounds.

The new battleships and battle cruisers will not only carry a complete equipment of electric auxiliaries but will also be electrically propelled. The electrification of auxiliaries is not of recent origin, nor has it been confined to purely military appliances. We find that on the new "California" there will be practically no work done directly by steam. Some of the many electrical devices on this ship are the motor driven ice cream freezer, the motor driven potato peeler in the galley, and the motor driven dish washing machine, the latter having a capacity of 1000 dishes per hour.

Following is a list of non-military electric auxiliaries:

Deck winches.
Anchor windlass.
Steering gear.
Forced draft.
Ventilation.
Pumps.
Capstan.
Engine turning.
Electric heaters.



C. G. SCHAFER

Electric ranges.
Electric bake ovens.
Miscellaneous galley appliances.
Refrigerating systems.
Machine tools.
Woodworking tools.
Laundry machinery.

In the case of the modern "motorship" we find most all auxiliaries electrically driven. The source of power for the auxiliaries is derived from two or more small Diesel motor driven generators, thus avoiding the necessity of an oil burning, steam raising plant. The modern ship of this type has no steam plant other than a heating system which is scarcely larger than that used in a fair sized modern home, and even this steam system may be replaced by electric heaters.

Until recently no great advancement was made in the electrification of merchant marine auxiliaries in this country, and except for Naval vessels there are only a comparatively few American built vessels which have a complete equipment of electric auxiliaries. On the Continent, however, there is one large shipping, trading, and manufacturing concern (The East Asiatic Company, of Copenhagen, Denmark), which now has in its fleets sixteen ships of 114,611 tons total carrying capacity, with twenty-three additional vessels under order. The majority of these are equipped, or are to be equipped, with electric auxiliaries.

This subject is today, however, rapidly claiming the attention of the American ship owner and ship builder, and there are already numerous instances of isolated electric driven appliances, such as a small work shop, turbine turning gear, refrigerating system, etc.

There are a few farsighted men in the industry who have already gone actively and earnestly into the subject of electric auxiliaries for shipboard. While none of the vessels so equipped are as yet launched, or in service, contracts have been placed for complete equipments of electric auxiliaries for sixteen general cargo vessels and bulk oil vessels, fourteen of which will have geared turbine propulsion, and two of which will have electric propulsion. General conditions indicate that these vessels will be followed by a large number similarly equipped. There are also a number of motorships of approximately 10,000 tons deadweight capacity in contemplation, that will utilize the electric motor for the auxiliary appliances. The application of electric drive to the auxiliaries of the Merchant Marine will not present any more serious difficulties than were encountered and successfully overcome in the steel industry, where there are several unusual obstacles, such as metallic dust, destructive fumes, severe service, rough and unskilled usage, etc. The problem of unskilled operators and attendants in the Merchant Marine resolves itself into the simple necessity of a little education and the proper kind of control devices. In this connection let us all be aggressive and not stand back and miss the wonderful advantages that electricity has brought to every other industry, merely because of the necessity for a little education.—The Journal of the American Society of Marine Draughtsmen.

SOME CIRCULATION!

"Le Matin" of Paris once held the circulation record, it issuing over 2,000,000 copies per day. This, however, has been beaten by the "Sunday Pictorial," a London paper with a circulation of over 2,430,000 copies per issue. Judging by the way subscriptions for "Motorship" are rolling in from all parts of the world the circulation of the above two newspapers does not surprise us in the least; but, we are getting nervous of causing a paper famine because of our popularity. However, we still have a few subscription blanks left. May we mail you one? The pleasure will be mutual!

WHO'S RIGHT AND WHO'S WRONG?

Here is an interesting case of "to be or not to be!" The East Asiatic Company of Denmark has ordered or in service altogether 44 motor-vessels of which 39 are big steel vessels of 9,000 tons d. w. c. Nothing similar has even been attempted by American shipowners! Now, 39 great motor vessels represent a lot of money, especially as 22 of them are building at today's high prices. So, either the East Asiatic Company are right and American shipowners wrong, or else the East Asiatic Company are foolish and American shipowners the wise-guys! Which is it?

NORWAY'S SHIPPING LOSSES.

Norway's total shipping losses since the beginning of the war to September stood at 639 vessels aggregating 932,000 tons, represented by 479 steamers and 160 sailing ships. Of these ships 319 of 515,000 total tons were sunk this year.

MOTORSHIP BUILDING IN SPAIN.

It may be remembered that early this year the Spanish Admiralty offered to give large orders to any responsible Spanish engineering company who would undertake the construction of marine Diesel-type engines for naval purposes, with the result that one concern purchased a Sulzer license. Since then two wooden shipyards have been started and auxiliary motorships are being built for commercial purposes.

One of these, the Valencia Shipbuilding Co., of Valencia, has laid down some 450-ton d. w. c. auxiliary ships. They are 150 ft. long and will be fitted with a 200 h. p. crude oil motor of Scandinavian make.

FERRO-CONCRETE SHIPS IN ITALY.

A company has been formed, with offices in Rome and a shipyard at Genoa, to build ferro-concrete vessels on a large scale. At present the capital is but $200,000, which shortly will be increased to $1,000,000. The name of this concern is the Societa Anonima Navi Italiana Cemento Armeco "Nica."

NEW ZEALAND TO BUILD MOTORSHIPS!

In New Zealand it has been proposed to build 300-ft. motorships of Kauri pine. They are to be four-masted schooners, equipped with an auxiliary Diesel engine of sufficient power to drive the vessel at 6 to 7 knots.

THE IMPORTANCE OF ACCESSIBILITY.

Experience with a 900 B. H. P. Marine Engine.

An idea of the importance of accessibility with marine oil-engines will be gleaned from the remarks made to us recently by the chief engineer of a motorship, and, designers will be assisted in their efforts if they pay due regard to this experienced man's communication. We will say that he is in charge of an American-built marine Diesel engine of nearly 1,000 b. h. p., and has been in charge of other craft equipped with American-built Diesel engines of smaller powers. The builders of this big engine have since changed their design, which, of course, emphasizes the value of experience.

This chief engineer says: "The piston outlet water-pipes inside the working and scavenger pistons are prone to loosen-up or break. This would be a simple job to repair; but, it is made formidable by reason that the whole engine must be dismantled, cylinders lifted off, and the pistons and rods hoisted up on deck in order to get at these pipes."

Now there is absolutely no real reason for such a state of affairs, and a marine oil-engine should be so designed whereby any part may be repaired or replaced, without disturbing or dismantling any other part of the engine. There are several such marine Diesel engines; but it should be said of all marine machinery that this can be done.

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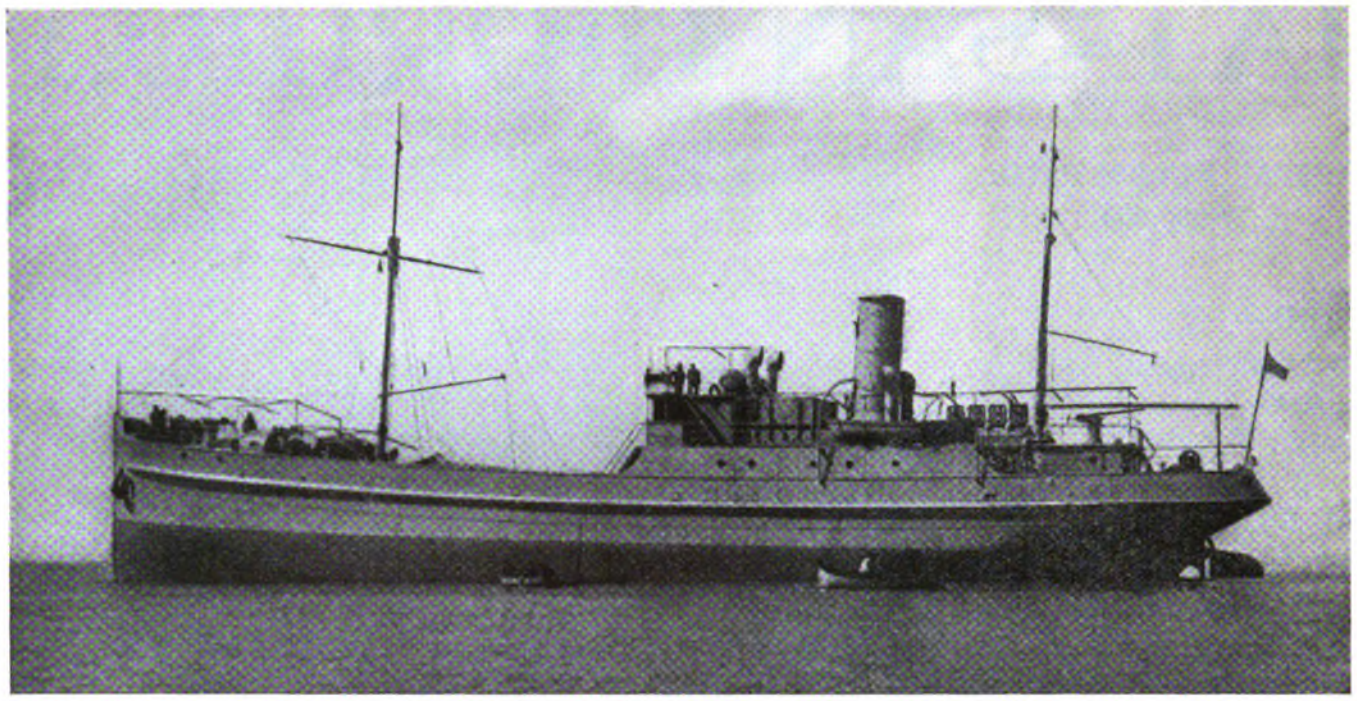
Five New Italian Diesel-Driven Tankers



ONE OF THE FIVE DIESEL-DRIVEN ITALIAN TANKERS

THERE are in the oil-carrying service in Italy five Diesel-driven motorships, which are owned by some very important people whose names we must not reveal at this juncture. These vessels are steel-built tankers, and have not long been in operation. Three of them were built and engined by Franco Tosi of Legnano, and two by the Fiat-San Giorgio, Ltd., of Spezia, and all have motors of the two-cycle type installed.

We are enabled to illustrate one of the three Tosi-engined vessels in question, and in each case a four-cylinder, 490 mm. by 625 mm. direct-reversible Tosi-Diesel oil-engine of the two-cycle type, developing 500 b. h. p. at 160 r. p. m., is installed.

The engine is a very striking engineering job, with beam-lever driven scavenging-pump arranged at the back and operated off the crossheads. On top of one of the pumps is arranged a three-stage air-compressor. The weight of each engine is 70 tons or 90 tons with complete equipment and propeller. Full ahead to full astern is carried out in eleven seconds. At an early date we hope to give further details regarding these interesting Tosi-engined boats, including drawings of the hulls and illustrations and details of their oil-engines.

MORE CANADIAN MOTOR AUXILIARIES.

The keel for the first of a fleet of wooden four-master auxiliary motor schooners recently was laid by D. H. Saker & Co., of St. Johns, N. B. Canada. The general dimensions of these vessels are: Keel, 165 feet; over all, 185 feet; beam, 40 feet; depth of hold, 18 feet; deadweight carrying capacity, about 1,000 tons. Contrary to the usual custom, the vessels will be launched beam on, or sidewise.

TAKES EXCEPTION TO THE VIEWS OF T. E. FERRIS, N. A.

"Editor Motorship:

"Dear Sir—I notice in your October issue an article giving the views of Mr. T. E. Ferris, N. A., regarding the manufacture and use of Diesel engines in the United States. His statement that our Diesel engines are theoretical shows that he has devoted about ten minutes thought to the subject. Had he investigated even for one hour, he would have discovered that the great majority of American Diesel machines are being built under license from European manufacturers, using the working drawings, templates, tools, identical shop practice, and that in a majority of instances the work is supervised by a man sent from the European factory, and that the machines turned out are identical in appearance, construction and operation with those of which he speaks so knowingly as having been 'built on actual sea-going experience.'

"He also states that engineers to operate these machines cannot be had, as yet. Therein he again tells how little he has investigated the subject. Every one of the Diesel engine concerns in the United States are now training men to operate these engines, and before a year has passed, there will be over two thousand thoroughly trained Diesel engineers in the United States. But from my experience with engine builders I find they are not keen to take steam engineers and attempt to make gas engine men of them. The average steam engineer is inclined to stand still. He has the idea, and generally expresses it, that gas engines are 'all right for yachts and such fool craft,' but utterly useless for the propulsion of real ships. Having served for over twenty years in vessels of all kinds, I believe I do not express myself too strongly when I say that I have met very few steam engineers who obtained more than 70 per cent efficiency from their engines and boilers.

"As Mr. Ferris truly says, 'The oil engine under ideal conditions works ideally.' 'Ideal conditions' reduced to common sense, means an engineer that knows his business and is not too lazy to take proper care of his engines. It sometimes means an owner who realizes that first class tools and supplies of various kinds are well worth the extra money they cost, in freedom from breakdown. And occasionally it means that both owner and engineer realize that a gas engine is a highly organized piece of machinery which cannot be handled with too much intelligence, and that the more the engineer studies the machinery in his charge, the greater satisfaction the owner will receive from its operation.

"It is a well known fact that no matter how inefficiently the valves of a steam engine are set, the engine will run and deliver some power. But let the valves of a gas engine go bad and the engine will barely pull its own load. Any attempt to do work, will result in a stoppage of the engine. For this reason I contend that the average steam man should not be placed in charge of a Diesel engine. For, say what you will, the steam engineer has a deep hatred for any kind of gas engine, realizing that this power is bound to supplant steam at an early date, and that he is temperamentally unsuited to operate anything but steam machinery. He will, therefore, be inclined to blame the engines if shutdowns are the result of his inattention. I know of one large installation—a city pumping plant—where a Diesel machine replaced steam. The steam engineer was carefully instructed in the operation of the new engine, but seemingly took little interest. The builder, speaking to me in regard to this installation, predicted trouble. Within a month the steam man had piston seizure and his explanation was that 'everything was going all right, so I just read the paper for a few minutes. All at once the engine stopped, and I could not start it again.' I went to the plant at once, and the engine exhibited every sign of lack of attention. I found the pistons badly scored and the bearings burned, necessitating entire dismantling of the machine. When the engine was again ready for operation, the builder insisted that he be permitted to supply the engineer. This was agreed upon and the plant has been in constant daily operation for over two years, with not a cent spent for repairs. But a thoroughly competent, factory trained gas engineer, is on the job. He has been operating gas engines of all kinds for several years, has never handled a steam plant, and has no desire to, and I don't blame him.

"No, let the steam engineer stick to his tea kettle. Do not waste time trying to make poor gas engine men out of good, bad or indifferent steam engineers. Gas and steam do not mix, and never will. FREDERIC T. O. WOOD,

"Marine Engineer.

AMERICAN COMPANY BUYS CANADIAN-BUILT MOTOR AUXILIARY.

The Canadian West Coast Navigation Company's sixth auxiliary schooner, which is nearing completion at the yards of the Cameron-Genoa Mills, Shipbuilders, Ltd., of Victoria, B. C., has been sold to American interests headed by W. B. Castle of Duluth, president of the Zena Iron Works of that city. The vessel will be christened when launched November 23 "Beatrice Castle," after the wife of the purchaser. This vessel is the last of the auxiliary schooners to be built under the initial program of Canada West Coast Navigation Company. Six were built by the Wallace Shipyards, North Vancouver, and six by the Cameron-Genoa Mills Shipbuilding Company of Victoria, B. C.

"S. I. ALLARD" COMPLETES RECORD VOYAGE.

The motor schooner "S. I. Allard" arrived at Portland November 14 after a fast run of fifteen days from Honolulu, bringing a load of copra from the Tonga Islands. Captain Mitchell, master of the vessel, reported encountering heavy northwest winds on most of the trip, otherwise still better time would have been made. The "Allard" left the Columbia River with a cargo of lumber for Sydney, Australia, and has made the round trip with cargo both ways in five months and six days.

SHIPBUILDING IN NORWAY.

According to latest returns there are on order with Norwegian shipbuilders 169 vessels aggregating 178,000 tons. Of these ships, 20,000 tons are represented by steel motorships, and 15,000 tons by wooden sailing-ships and motor-auxiliaries.

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